Level of the Mathematical Literacy among the University Students

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Study aimed to investigate the mathematical Literacy level among Hashemite University students. The sample comprised 40 male and 160 female students, the researcher constructed a test to explore the mathematical Literacy level among the students, the results showed a low level of math Literacy, and in all its dimensions (Math nature and its development history; Basic math concepts; Basic skills and functions; Life math applications; and Mathematics as a way of thinking. The results showed that the math Literacy was better among the female than the male students, in t Basic concepts dimension; basic skills and functions dimension and in the overall test of the math Literacy.

INTRODUCTION

School mathematic passed through multiple development stages. It shifted from traditional to modern math, which was reconstructed around more comprehensive concepts, and attempts to use more accurate and easier language and symbols. Thence, math moved from its revolution in concentration on applications and procedures, to concentration on developing understanding and thinking. Therefore, a large space appeared in the math curricula for the concepts, relations, principles and generalizations, in addition to problem solving and math thinking (Mirsal, 2016).

As a result of this revolution, which climaxed in the last ten years, the concerned parties in school math development announced that the challenge facing the math teachers in this era is highlighting the development of certain concepts in modern math, including math Literacy, particularly during the early stages (For instance, National Council of Teachers of Mathematics "NCTM", 2000; Organization for Economic Co-Operation and Development "OECD", 2000). Such development requires concentrating on how students think mathematically, and how they learn mathematics.

Math Literacy is a long-term goal -in its development- about the routines and procedures that rely on learning by heart and memorization. However, the objective lies in developing general understanding and perception of numbers and operations on them. It also includes the use of the numerical system in fast and flexible ways, to face the multiple (familiar and unfamiliar) problems, and to depend on mental calculation and evaluation (Güneş, Berna & Günhan, 2013).

Nelson, Joseph & Williams, (2000) and OECD, (2004) ascertain that math Literacy development requires distinguished math construction, and diversity of its teaching strategies, taking into account the cognitive structure with the students and problems they face. In this regard, Tanner and Jones (2000) assure that math Literacy is among the aims that lead to the math thought development and trends towards math. It depends on discussion and encouraging students to mediate and form the intellectual image and functions on them; linking the students with their environment; and providing many ways and harmony in the teacher's movement, due to the multiplicity of the math Literacy dimensions.

Soon, many studies emerged to determine math nature, dimensions and its development ways. Cooper (2008) and Kilpatrick (2001) stressed the importance of math Literacy as a direct planned objective by the teachers, and the need for concentrating on designing the educational environment to develop it. Boaler (2007) and OECD (2004) recommended the necessity to reduce traditional subjects that depend on the "mechanical" algorithms and heavy load of routine paper and pencil work, such as operations on the numbers, with emphasis on the mathematical Literacy.

Math Literacy is concerned in introducing math in a genuine context to gain its meaning through other scientific concepts, and exhibit the math concept through stories, games and drama. The Literacy is further concerned in that students should use math in their different life aspects, and explore the math history and development; thereby a math Literacy supporting environment will be created (Gellert, 2004; Greer, 2010).

Little (2000) stated that math Literacy includes things far beyond the comprehension of math concepts and skills. It includes multiple-dimension contents about math and its relationship with other areas of study. The student is in need to understand the math nature as problem solving, surveying, extrapolation, and technology and relations among them. He is also in need to know the role of math and technology in the personal life and community.

Skovsmose (2004) sees that math Literacy concept consists of understanding math nature and concepts, and perceiving the effect of math and technology in the community. In an analytical study carried out by Jablonka (2003), on understanding the math Literacy nature, interrelated relations and factors affecting the Literacy, she concluded many affecting factors in understanding math Literacy nature. For instance, she referred to the nature between math and the surrounding context of the individuals, and the relation between the school math and math outside the school. She also defined four concepts which, as a whole, show the math Literacy nature, namely: ability to use basic arithmetic and geometric skills in life contexts; understanding the basic math concepts; ability to construct reality-related math models; and ability to understand and evaluate others' utilization of the different math patterns.

Education department in South Africa University conducted an educational project focused on setting a proposed list of the math Literacy standards. This document included many standards that should be available when implementing the curriculum. They are ways of dealing with numbers, treating the numerical styles through different ways, understanding the historical development of mathematics in various social contexts, use of the math relations in the social, political and economical contexts, use of accurate measurements in multiple contexts, and use of data from various sources to make scientific judgments (Mirsal, 2016).

NCTM (2000) defined a pool of basic skills required for the citizens to be mathematically educated, within the framework of what is called "functional mathematics." The document further emphasized the need to include math subjects (life applications) that comprise problems that face students in their life and works; for instance, census, weather, climate, profits, and budget. Emphasizing the math Literacy role, OECD institution started providing periodical issues since 2004, which contain reports about evaluation of math Literacy level among a large sample of students from many countries. These reports contributed to characterizing the math Literacy concept and identifying its main ingredients.

As for the "numerical Literacy project in the teacher's education: a way to the twenty-first century", it aimed to provide a cognitive base about the numerical Literacy and mathematics, assert understanding of the numerical Literacy nature and study of the entrances and ways to develop it into pre-service teacher preparation programs (Board of Teacher Registration, 2005). The National Curriculum Statement document (NCS, 2001) about the math Literacy indicated basic keys to understand the nature of the math Literacy. They included elementary stage math content, use of math in real contexts, and solving familiar and unfamiliar problems.

On the other hand, Glaister and Glaister (2001) see that math Literacy is a compound consisting of three components: symbolic component, interested in developing the cognitive abilities; social component that produces the applied math value; and, cultural component that searches for alternatives to understand the math phenomenon. These three components contribute to the math education process. However, Hope (2007) added another component to the math education, which focused on enabling the learner's values

and building concepts of the math Literacy. Still, Adeyemi and Adaramola (2014) added a new component to the math Literacy, which focused on pleasure, beauty and self-satisfaction when the student finds a math problem solution.

In the light of the above, the researcher sees that math Literacy components fall within two areas. First, the cognitive and skill area, which includes acquiring basic math knowledge and skills, ability to use them in solving scientific and life problems, and understanding math and its developmental history. Second, the emotional and social area, which includes a pool of values and trends that may be formed with the students toward math nature, applications and teaching-learning.

Pursuant to the revision of math Literacy -related literature, such as: (Afkhami, Alamolhodaej & Radmehr, 2012; Glaister & Glaister, 2001; Hajabm 2015; Hakanm, 2015; Rafiepour & Stacey, 2009; Shava, 2005: Skovsmose, 2004), the researcher adopted the following dimensions: the nature of math and its developmental history, Which deals development of counting and numbering systems, history of geometry, trigonometry, calculus, and algebra with its types.

Basic math concepts dimension, Which deals the arithmetic concept and their teaching methods: numbers, metric system, place value of the number, regular and decimal fractions and approximation, percentage, exponents and their rules, number analysis, operations on numbers, circumference, area, size (volume), proportion and proportionality, measurement of lengths, areas, volumes and time, basic operations and skills dimension, which searches in the use of procedural math ways, such as arithmetic operations , induction and inference, application of math rules, linking processes higher than the previous procedural level, drawing, measuring and equation solving,

In addition, there is the life math applications dimension, which focuses on problem-solving in all the different life aspects, and illustrating the role of math in the cultural growth. As such, the applications are employed to instigate learning as a means of problem-solving, cultivate the taste of math aesthetics, and math development, appreciation and love. Applications vary in their levels and qualities, from a routine one on certain concepts and rules, to one on problem-solving, and one on an innovative application that provokes new expansion to math subject and applications.

Undoubtedly, the student in the beginning is in need to know simple, attractive, and real applications, that grant life to the numerical and geometric ideas and styles, which show the aesthetic and beneficial aspects of math, side by side with other formal applications that exist in the schoolbook. We can also add another dimension, which is math as a way of thinking interested in developing joyful thinking tools through mathematics, and how innovative thinking habits could be learned and developed. Thus, we can describe a person as mathematically educated if he owns a solid math background in the basics of the math knowledge and ability to apply; clear understanding of the math nature; positive attitudes towards math; and perception of the math value in the community and how it has a role in problem-solving and decision-taking.

Schoenfeld (1992) maintained that students should own the math structures to gain proper math Literacy, which qualifies them for that purpose. However, what is going on in reality is that math teaching is represented in the math teachers' focus on the cognitive dimension of the math Literacy. Many studies and literature emphasized the importance of math teaching according to the math Literacy concept framework, through the use of the math cultural and community dimension, which allows a "room" to discuss life problems the students face in math contexts that stemmed from their actual reality. The math role is quite prominent in solving these problems, and assures that math is not isolated from the beliefs, value and students' life-related situation. Rather, math is an integrated part of all these, and leads to increase their math achievement, and form positive attitudes toward math (Soobard & Rannikmae, 2011).

NCTM (2000, 2001, and 2009) recommended paying more attention to the math Literacy and placing it within general Literacy, as an emphasis of the importance of language, writing and arithmetic in forming the individual's math Literacy, which makes him able to communicate with the ever changing and renewable life requirements. The above recommendation was formed under the slogan "math as a means to communicate". Many studies and literature, for instance, Garfunkel (2013) and Mahdiyansyah (2014) underpinned the importance of identifying the cultural background of the learners, and the attempt to link it with math learning, which allows them to learn through communal cultural ideas. Thereby, the

school math content comes consistent with the math roots embedded in the local community Literacy; based on the fact that math Literacy is similar to the political, social, economical and ideological structure. This encouraged a number of researchers to depend on ethno-mathematics as an entrance to develop math Literacy among learners in the different educational stages. Also, as a base to math learning-teaching to be the beginning of the bridge the learner crosses to understand math, its high-end language, and its role in his life to construct his future and self-understanding (Levenberg, 2015).

Therefore, the class teachers' preparation programs are in need for placing more attention to the math Literacy process of the future teacher, in addition to attention to provide the teacher an in-depth understanding in the university major area and educational area. In this respect, Hakanm (2015) emphasizes the importance of a balance between class teacher's imperative of mastery of the basic math subjects included in the curriculum, and the imperative of having math Literacy.

In this concern, math Literacy required for the teacher is different from that of the ordinary citizen. While the ordinary citizen needs an amount of math concepts and skills and their practical applications to interact with his community, and solve his problems, the teacher needs more amounts of math Literacy. Such amounts help him teach and learn math and enable him to solve his problems in the different life aspects. The math Literacy required for the teacher includes rigid math background in facts, concepts, math theories, basic skills, and ability to apply the components of this background, which should remain firmly rooted in the class teacher's cognitive structure, not easily forgotten. In addition, the class teacher should possess clear understanding of the math nature, positive trend toward math, perception of math value, and knowledge about how math affects the community (Adeyemi & Adaramola, 2014).

The questions is: did the class teacher's preparation programs in universities provide him with proper math Literacy, that enables him teach math efficiently, and help him develop math Literacy among his students in the basic education stage? Results of the studies showed cases of students who refused math, felt afraid of the subject, did not like it, and made it the last and least choice to study. To what extent could the math Literacy be a reason for this? Moreover, how could the math Literacy assist students to enjoy math, and transfer problem-solving skills to new situations? Many beliefs and questions about the impact of Literacy on school math teaching are submitted for debates (Afkhami, Alamolhodaei & Radnegr, 2012).

The weakness of math Literacy level may be one of the reasons of the negative attitudes among the students towards mathematics, failure to recognize the impact of math in life, low achievement level, or poor thinking abilities. Building this Literacy may be one solution for this problem. Many studies showed a low level of the teacher students' acquisition of math Literacy in the class teacher preparation programs.

In this concern, the study of Mahdiyansyah (2014) indicated that math Literacy level among the secondary education students was low. Many students were only able to understand a certain math concept, but unable to link between math concepts and math applications to reduce the daily life problems. Study of Arasian and Yavus (2012) investigated the teachers' beliefs on the math Literacy. The sample consisted of 140 male teachers enrolled in the MA program in Istanbul University. The results showed a low level (less than medium) of the teachers' beliefs.

In the study of Rafiepour and Stacey (2009), the authors stated that the math curriculum content in the education colleges contributed to the basic concepts of the school mathematics at a limited amount only. Study of Tai CH & Hung (2014) showed a lack in math efficiencies at the level of remembering math definitions, theories and rules, and a lack at the level of their use in problem-solving. In addition, there was an insufficiency in the teacher students' understanding of math structure and nature. Villena (2008) conducted a study aimed to determine the math Literacy level among a sample of the last year of the secondary schools. The sample comprised (115) male and female students, and the results showed a low level of math Literacy among them.

Al-Sirr (2005) made a study that showed that math Literacy level was low among the math students in the faculty of Education, Al-Aqsa University, Gaza. De Lange (2003) also concluded that the relation between the university math modules and the school math modules was weak. As a result, these studies emphasized the need for more math modules closely related to the school math curriculum, and that they should include the basic concepts of this curriculum.

Since math Literacy is one of the most important outcomes of math teaching, and the focus of the educators' concern, both currently and anciently, modern math education standards indicated the importance of making the students able to appreciate the natural world knowledge, as well as the math value and scientists (NCTM, 1997). In the light of the above, and due to the repetitive calls to spread out the math Literacy and its importance among students, this study was made to investigate the level of math Literacy among the students whose major is "class teacher" in the Hashemite University.

Study Problem

The studies that dealt in math Literacy level among the students and citizens in many countries of the world, both the developed and developing, showed that they are lower than the desired level (Al-Sirr, 2005; Dilek, Recai & Guney, 2013; Galbraith, Blum, Booker & Huntley, 2008; Rafiepour & Stacey, 2009: and Tai & Hung, 2014). They also found that mathematically educated teachers rely on an abundant repertoire of technical and applied knowledge, knowledge of the math nature, learners' characteristics and values, and their philosophical and historical bases (Kramarski & Mevarech, 2003).

The researcher, through teaching the students of class teacher major three courses (math concepts and their teaching methods; numbers and operations on them and their teaching methods; and geometric concepts and their teaching methods), found an urgent need to understand the math nature, and develop positive trends toward it. In the beginning, the researcher found mixed feelings, disturbed images about math, unclear perception of the importance of what they learn and its benefit in math teaching, and weak students' abilities to deal mathematically with the math situations and problems. Furthermore, they have conceptual and procedural mistakes in dealing with many of the math problems, and negative attitudes toward math study.

Due to the differences in teachers; math Literacy, as illustrated in the previous studies, this study came to shed light on the math Literacy level with the class teacher major students in the Hashemite University. The study problem was coined as follows: What is the math Literacy level of the Hashemite University students? Does math Literacy differ among these students by gender?

METHOD AND PROCEDURES

Study Population and Sample

The study population consisted of all the students majoring in class teacher in the Hashemite University, Educational Science College, Methods and Teaching Department. This major aims at preparing them academically, professionally and educationally to be able to teach the first three classes in the basic education stage. They were (300) male and female students (240 females and 60 males). The sample participants were chosen by the intentional random method from the students who studied the following modules: math concepts and teaching methods; geometric concepts and teaching methods; and numbers and the functions on them and teaching methods. The sample consisted of 200 participants (160 female and 40 male students), and the researcher applied the descriptive approach.

Math Literacy Level Test

The test aims at measuring the math Literacy level among the students majoring in class teacher, according to the definition of the math Literacy as: "Group of knowledge, skills and attitudes that enable the student deal with math knowledge and its modern application, and role of math in solving reality problems in the individual's daily life" (Glaister & Glaister, 2001; p5). For the purposes of this study, math Literacy level was defined procedurally as the degree the student obtains in the test prepared for measuring the math Literacy level.

Pursuant to the revision of the math Literacy -related literature, such as: (Afkhami, Alamolhodaei & Radmehr, ؛2012 Hakanm, ؛2015 Glaister & Glaister, ؛2001 Rafiepour & Stacey, 2009 ؛ Shava, ؛2005 Skovsmose, 2004), the following domains were adopted as components of math Literacy. Math nature and its development history, basic concepts in math, basic functions and skills, life math applications, and

math as a way of thinking. Table (1) illustrates the math Literacy aspects, the degree allocated to each aspect and their relative weight.

TABLE 1
MATH LITERACY ASPECTS, TOPICS, NUMBER OF ITEMS ALLOCATED TO EVERY ASPECT, AND THEIR RELATIVE WEIGHT

Aspects	Topics	No. of Items
Math nature and its development history.	Abstract nature, systematic nature, educational view, aesthetic view, math in the Arab World and the West.	8
Basic concepts in mathematics.	Math concepts in every topic of mathbranches (numbers, geometry, algebra, measurement, statistics and probabilities)	8
Basic functions and skills	Math skills in every topic of math branches (numbers, geometry, algebra, measurement, statistics and probabilities)	8
Life math applications	Mathematics for life	8
math as a way of thinking	Viewing math as a way of thinking	8

The researcher coined 40 items on the five aspects, and presented to 12 specialized arbitrators. The items were amended by deletion, addition and adjusting certain items, in the light of their comments. The instrument comprised 40 items in its final shape, where 1 grade was given for each correct answer and no grade (0) if the answer was wrong.

The test was applied on a sample of 60 male and female students majoring in class teacher, from outside the study sample. Their responses were used to analyze the questionnaire items by obtaining Pearson correlation coefficient between the response on the item and the degree on the dimension it relates to. The results showed a statistically significant correlation at (α=0.05) level between the degree of each item and the degree on the dimension, the Reliability coefficient of every dimension of the test, as well as overall reliability were calculated, as shown in Table (3).

TABLE 3
RELIABILITY COEFFICIENTS OF THE MATH LITERACY TEST DIMENSIONS AND OVERALL RELIABILITY

Math Nature and Development History	Basic Math Concepts	Basic Functions and Skills	Life Math Applications	Math as a Way of Thinking	Overall Test
0.81	0.83	0.80	0.82	0.83	0.84

The value is acceptable for the purposes of the study, and the overall degree of the test was around (40). The overall degree of the student is taken by adding the degrees he obtains on each item, and the test time was 60 minutes. The arbitrators agreed that the degree of the test should be 70%.

RESULTS AND DISCUSSIONS

Q1: What is the math Literacy level of the Hashemite University students? For answering this question, means (M's) and percentages of the students' degrees were calculated as shown in Table (4).

TABLE 4
M'S AND PERCENTAGES OF THE STUDY SAMPLE PARTICIPANTS' DEGREES ON THE MATH LITERACY TEST

Dimensions	Mean	Percentage
Math nature and its developmental history	1.88	24%
Basic concepts in Math	5.53	69%
Basic functions and skills	4.75	59%
Life math applications	2.69	34%
Math as a way of thinking	2.83	35%
Math Literacy level	3.54	44%

Table (4) illustrates that the students' degrees mean and percentage of the math nature and its developmental history dimension were 1.88 (24%), and were 5.53 (69%) in the basic concepts in math. Other dimensions were as follows: basic functions and skills: 4.75 (59%); life math applications: 2.69 (34%); math as a way of thinking: 2.83 (35%). The average mean and percentage of these dimensions were 3.54 (44%). These means and percentages are generally low, except for those of basic concepts in math, which were close to mastery level.

As for the math nature and its developmental history, results of Table (4) show that class teacher preparation programs in the Hashemite University did not contribute to the development of math Literacy with the students. This is particularly clear in the math nature and its developmental history, basic functions and skills, life math applications, and math as a way of thinking. This could be ascribed to the lack of a specialized course in math nature and its developmental history. Furthermore, the researcher reviewed the plans of other courses and found them lacking these subjects. In this concern, class teacher major students study three courses, namely: math concepts, numbers and operations on them, and geometrical concepts. For instance, plan of math concepts courses include math structure, math knowledge, school math principles, and their teaching criteria. It also included concepts of comparison, patterns, counting, numbers and place value of the number, odd and even numbers, primary numbers, ordinary fractions, approximation, and metric system, and some math applications and teaching methods.

The plan of the numbers and operations on them course dealt the natural and real numbers, fact and mental calculation, common denominator, common multiplier, divisibility, proportion and proportionality, fractions and percentage, exponents and roots. In addition, the plan of the geometric concepts dealt the point, line, the geometrical shapes and figures, polygons, areas, sizes (volumes), coordinate geometry and conversion geometry.

The researcher believes that the reason for the students' weakness in the math nature dimensions is closer to the intellectual and philosophical concepts, which students do not like to study and make them a part of their Literacy. He also ascribes this to the lack of topics and/or courses, both at school and university in Jordan, which are interested in math philosophy, objectives, and nature; or courses that develop positive trends towards math and its importance and role in the community, particularly the BA degree stage.

Another reason for this result may be the poor attention to the class teacher preparation program, particularly in math history, math thought development, and math application in life. This was further supported by the study of Baydar and Bulut (2002), which stated that care should be placed to the higher education levels for learning the basic concepts, skills and functions, which contribute to maintaining learning effects. They also support the possibility of learning them in the mental structure of the teacher student, to an extent that facilitates retrieving them, and using them in the right manner at the right time.

As for the basic concepts dimension in math, which was close to mastery level, and basic functions and skills dimension, this result is in agreement with the study of Mumba, Chabalengula & Hunter (2006). Those researchers found that the scientific knowledge dimensions ranked first in terms of the students' performance in the tests, which were designed to measure this dimension. This is quite natural in

that the scientific knowledge of the facts, concepts, rules and theories is very important for students' learning, which they cannot do without. In addition, students should gain more amounts of this knowledge to enable them successfully to complete this subject and pass its examinations (Dani, 2009).

This result could be further explained by the intensive teachers' focus on providing their students scientific information, while ignoring developing their thinking and inquiry skills, which reflects on the students. Therefore, students resort to learn them by heart, and then "recall" them at the examination time when they are required to do so. Moreover, the examinations per se are considered a reason that drives students to a lower level of math Literacy, in both thinking and problem-solving dimensions; because they tend to test information on facts, concepts, principles and theories, but ignore evaluation of the different skills. In this regard, it is vitally important, in the issue of cultural math development, not to focus exclusively on the scientific knowledge, where math is not seen as a mere cognitive content (Roberts, 2007).

As far, the math as a way of thinking dimension, and life math applications dimension are concerned, they were at low rates and students' performance was very poor on both. This is a serious indicator that math teaching is still focusing on learning the information by heart, and very little portion of teaching focuses on developing thinking skills and problem-solving, in spite of the efforts spent by both the Ministry of Education and Ministry of Higher Education in Jordan to propel toward focusing on developing the student's ability to interpret, analyze and solve the problems.

Many reports and previous literature (OECD, 2007; Sadler, 2009) asserted this reality, and provided that students are facing difficulties in their problem-solving abilities, and decision taking about their daily life problems. They maintained that it is quite important to focus on this dimension through training the students, during their study of the different scientific subjects, on solving the problems of the community they live in (Soobard & Rannikmae, 2011).

This could be because students are not assigned external duties that enrich their math knowledge, and raise their cultural level. In addition, there are certain factors that lessen the students' math Literacy level, such as continuous reliance on traditional teaching methods, remaining in the same classroom, and receiving the information from the teacher. The formation of the math Literacy with the student needs giving him freedom in discussing the subjects he wants; unleashing his mind to reflect on them deeply; attempt to apply them on reality with the help of the teacher; and teacher's evaluation of the validity of this application. This will implant the information the student received in his mind, keep them saved in his memory, and help him to expand on them, and, subsequently, form a broad scientific, cultural background, which will be used in his career.

Considering the above, it is clear that the math Literacy level in this research, whether at the text level, as a whole, or its five dimensions level, was less than the educationally desired level, given that the teacher is a mathematically educated person. This is due to many reasons, which were indicated earlier in this study. However, it is very beneficial to explore the specialized courses for math teaching and the teachers' implementation, especially in inquiry, thinking and problem-solving. The inquiry content in these courses was not dealt with as a mental process that, once taken care of, leads the students to possess mental functions such as: interpretation, predicting, measurement, and the like. The reason may also be the absence of the science philosophy role as a reference for the teacher, when he takes the decision to choose, design, and execute the teaching tasks. In this connection, certain teachers' decision-taking relies on administrative or social factors, regardless of the cognitive factors. This resulted in a large gap between the scientific Literacy development and teaching practices.

This result agrees with studies of De Lange, (2003), and Rafiepour and Stacey (2009), in terms of the low level of the math Literacy. Through reviewing certain characteristics of the scientifically educated person, we find that he is the one who is able to perceive and understand mathematics in a conceptual, historical framework, instead of dealing with them as dissonant, scattered information. He also believes that the scientific ideas are improvable, adaptable, and scalable. Such characteristics were not apparent in the students' answers on the math Literacy exam.

This result is in line with the results of Shava (2005), and OECD (2005). The results of low math Literacy levels with the students could be ascribed to the fact that most school curricula did not deal in the

math nature, math inquiry nature, or interaction between math, technology and community. They did not achieve the modern curriculum standards, especially those concerning the math Literacy level. In addition, teachers of one major cannot perform all the work to achieve the upgrade of the mathematics cultural level with the students. Rather, all teachers, notwithstanding their majors, and all the stakeholders in the individual's education, in general, have their roles to achieve this; an issue asserted by Boaler (2007).

The results of our study are in line with those of the study of Boehner (2000), which aimed at measuring the level of math Literacy with the students of both the first and fourth levels of the math majors, and the role of the teacher preparation programs in its development. The study showed that the increase achieved in the math Literacy level through teaching math modules to the teacher students, over four years, did not upgrade them to the defined level, which was set at (80%) of the overall degree. These results are also in line with those of Julie (2006), which showed low level of math Literacy with the math teachers that enable them to face the math and technical changes.

This result could be ascribed to that teacher preparation programs before and during service, as well as the university plans, do not pay sufficient attention to the math Literacy aspect. Rather, focus is made on the cognitive content and math concepts, merely to obtain the aspired degree. Furthermore, the attention of the teachers during the teaching process is directed toward the theoretical aspect, and providing it to the students in a traditional way. On the other hand, lack of math Literacy module, in both public and private universities in Jordan, for the students majoring in mathematics, and the curricula, teaching methods and examinations focus, in general, on the specialized math concepts, led to this result.

Results of the second question: Does math Literacy among the class teacher major students differ by gender? To answer this question, M's and SD's of the sample participant's performance on the math Literacy exam, and its dimensions, as per the group, as shown in Table (5).

TABLE 5
M'S AND SD'S OF THE SAMPLE PARTICIPANT'S PERFORMANCE ON THE MATH LITERACY TEST AND IT'S DIMENSIONS AS PER THE GROUP

Dimensions	Group	No.	M	SD
Math nature and its developmental history	Females	160	1.92	1.00
	Males	40	1.73	0.85
Basic concepts in mathematics	Females	160	6.40	1.38
	Males	40	2.05	1.13
Basic functions and skills	Females	160	5.31	1.68
	Males	40	2.48	1.28
Life mathematics applications	Females	160	2.74	0.93
	Males	40	2.50	1.13
Mathematics as a way of thinking	Females	160	2.98	0.97
	Males	40	2.79	0.86
Math Literacy level	Females	160	19.22	2.95
	Males	40	11.52	1.93

Table (5) shows apparent differences in the means among the males and females' degrees in the overall Literacy exam, and on all its dimensions. To examine these differences, Wilkes Lambda's value was calculated, which was 0.35, corresponding F value is 70.71, and statistical significance 0.00. Furthermore, the researcher applied MANOVA analysis. Table (6) shows the results of the male and female students' degrees on the math Literacy test, in general, and on every dimension, separately.

TABLE 6
MANOVA ANALYSIS OF THE EXPERIMENTAL AND CONTROL GROUPS STUDENT'S DEGREES IN THE POST APPLICATION OF THE MATH LITERACY AND ITS DIMENSIONS

	Dimensions	Total Squares	df	Squares Mean	F Value	Sig.
Group	Math nature and its developmental history	1.20	1	1.20	1.28	0.26
	Basic concepts in mathematics	605.52	1	605.52	338.39	0.00
	Basic functions and skills	257.65	1	257.65	99.57	0.00
	Life mathematics applications	1.80	1	1.80	1.89	0.17
	Mathematics as a way of thinking	1.05	1	1.05	1.17	0.28
	Overall Test	1770.13	1	1770.13	228.81	0.00
Error	Math nature and its developmental history	185.92	198	0.94		
	Basic concepts in mathematics	354.30	198	1.79		
	Basic functions and skills	512.35	198	2.59		
	Life mathematics applications	188.98	198	0.95		
	Mathematics as a way of thinking	177.17	198	0.89		
	Overall Test	1531.75	198	7.74		

Table (6) indicates statistically significant difference at (α=0.05) level between the means of the students' degrees on the math Literacy test, ascribed to the gender variable, in favor of the females, in the following dimensions. Basic concepts in math: F=338.39 and significance =0.00; basic functions and skills: F=99.57 and significance =0.00, and, F=228.81 and significance =0.00 in the overall test of math Literacy.

This may be ascribed to that, females remain at homes for longer periods than males, and allocate more time for study and follow-up. This is particularly true in the dimensions were the female students outran the males, which depend on study and follow-up (basic concepts in math, and basic functions and skills). Many of the courses provided to the class teacher students tackle the primary math concepts, and basic skills in math. They view more TV stations, and are more concerned in the various social media, which contain important resources of Literacy. As for the males, they spend more times outside homes with colleagues and friends, and return to spend the remainder of the day with the family. As a result, they do not have sufficient time to obtain scientific Literacy, as compared with the females. Our study is not in line (in this particular aspect) with the results of (Afkhami, Alamolhodaei & Ramdehr, 2012; Julie, 2006).

On the other hand, table (6) did not show statistically significant difference at (α=0.05) level between the means of the students' degrees on the math Literacy test attributed to gender variable, in the math nature and its developmental history, life math applications, and math as a way of thinking dimensions. In this concern, the values were F=1.28, significance=0.26; F=1.89, significance=0.17; and F=1.17 and significance=0.28, respectively.

Possibly, this could be attributed to that both male and female students share the same math Literacy level, as they depend on the academic curricula themselves, with no attention to extracurricular activities, or those supporting the curriculum, which form their math Literacy. Math Literacy is formed through their search, exploration and use of the applied scientific methods in their study.

This result could be ascribed to that most of the sample participants studied in the Jordanian schools, particularly the same math curriculum for ten previous years. They live in a community, which is, to some extent, consistent in its habits, traditions, values and problems that face its members. They all lived the same educational experience, and studied almost the same courses in the university. In addition, the

Media is the same, whether it is of the read or audiovisual types. All these are likely to interpret the results this study concluded. Our results are in line with (Shave, 2005).

This result indicated that class teacher students, in general, whether males or females, possess a very close level of math Literacy. This in itself provides a signal to the Ministry of Higher Education, in the form of the following question: Is the current public education is at the desired level, which enables students acquire math Literacy that helps them deal with the age requirements, on one hand, and its various challenges, on the other?

RECOMMENDATIONS

In the light of the results of the study, the researcher coined the following recommendations:

- Inclusion of math Literacy concepts in the pre-service/in-service teacher's preparation programs, and developing them to keep abreast to the modern developments, and continuous evaluation of these programs.
- Inclusion of math Literacy concepts in the school curricula and books in the light of the modern math standards, and continuous evaluation.
- It is quite necessary to raise the math Literacy level with the students, by paying attention to the different teaching strategies, following evaluation strategies and its suitable tools, linking education with practical life and community. It is also necessary to amend the teaching plans in a manner that provides students a firm base of scientific subjects, with efforts to deepen the subjects to ensure ingraining the information with the students, and concentrate on the practical aspect in math teaching.
- Training teachers on thinking development strategies with the students, through providing various workshops.
- Paying attention to the inquiry issue, and upgrading it from the simple to the higher level, where the student is the party who asks, plans, and carries out the inquiry activity.
- Investing the scientific abilities of the university to enrich the students' knowledge, and raise the math Literacy level with them.

REFERENCES

Adeyemi, O., & Adaramola, M. (2014). Mathematics Literacy as a Foundation for Technological Development in Nigeria. *J. Res. Method Educ*. 4(5), 28-31.

Afkhami, R., Alamolhodaei, H., & Radmehr, F. (2012). Exploring the Relationship between Iranian Students' Mathematical Literacy and Mathematical Performance. *J. Am. Sci*. 8(4), 213-222.

Al-Sirr, K. (2005). Math Literacy Level with the Mathematics Department Students, Faculty of Education, Al-Aqsa University, Gaza. *Faculty of Education Journal*, 29(1), 199-242.

Arasian, C., & Yavus, G. (2012). A study on mathematical literacy self- efficacy beliefs of prospective teachers. *Social and Behavioral Sciences*, 46, 5622-5625.

Baydar, S., & Bulut, S. (2002). Importance of teachers' beliefs about nature of mathematics and teaching of mathematics in mathematics education. *Journal of Hacettepe University Education Faculty*, 23, 62-66.

Boaler, J. (2007). *Multiple perspective on mathematics teaching and learning* (pp. 83-104). Westport, Connecticut: Ablex Publishing.

Board of Teacher Registration. (2005). *Numeracy In teacher education: the way forward in the 21th century*. A report of the numeracy in pre- service teacher education working Party. Australia, Queenlands: Queenlands College of teachers.

Boehner, B. (2000). *Issues and Trends in research on Mathematical Education*, Niss. M (speaker) at Plenary Lecture 31st July 2000 in Denmark In.

Cooper, D. (2000). Navigating the thorny Path: A Colloquial Definition of Mathematical Literacy with Connections to Various School Mathematics Standards. *http://ehrweb.aaas.org/her/forum/cooper.html (7/7/2018)*

Dani, D. (2009). Scientific literacy and purposes for teaching science: A case study of Lebanese Private School teachers. *International Journal of Environmental & Science Education*, 4(3), 289-299.

De Lange, J. (2003). *Mathematics for literacy*. In B. Madison & L. Steen (Eds.), Quantitative literacy: Why numeracy matters for schools and colleges (pp. 75–89). New Jersey: The National Council on Education and the Disciplines.

Dilek, S., Recai, A., & Güney, H. (2012) The Effect of Prospective Teachers' Problem-Solving Beliefs on Self-Efficacy Beliefs About Mathematical Literacy, *Journal of College Teaching & Learning*, 9(4), 289- 298.

Galbraith, W., Blum, G., Booker, A., & Huntley, D. (2008), *Mathematical modeling: Teaching and assessing in a technology-rich world* (pp. 291-300). Chichester: Horwood Publishing.

Garfunkel, S. (2013). *For All Practical Purposes Mathematical Literacy in Today's World*. New York: W. H. Freeman and Company.

Gellert, U. (2004). Didactic material confronted with the concept of mathematical literacy. *Educational Studies in Mathematics*, 55, 163- 179.

Glaister, E. & Glaister, P. (2001). The Role of Applications in Mathematical Teaching and he Enhancement of Mathematics Learning through Project Work. Centre for Innovation in Mathematics Teaching at Extern University. *http://www.ex.ac uk/cimt/ (12/8/2017)*

Greer, A. (2010). *Mathematical Communication: A Study of the Impact Expository Writing in the Mathematics Curriculum Has on Student Achievement***.** Unpublished doctoral dissertation, Capella University.

Güneş Y., Berna C., & Günhan, E, (2013) Self-Efficacy Beliefs of Prospective Primary Mathematics Teachers about Mathematical Literacy, *Journal of College Teaching & Learning*, 10(4), 279-288.

Hakanm, K. (2015) Examination of Factors Affecting PISA 2012 Mathematical Literacy through Mediation Model, *Education and Science*, 40(179), 45-55.

Hope, M. (2007). Mathematical Literacy. *Principal Leadership*, 7(5), 28-31.

Jablonka, E. (2003). *Mathematical Literacy*. In A. Bishop, M. Clements, C. Keitel, J. Kilpartrick & F. E. Leung (Eds.), Second international handbook of mathematics education, (pp 75-102). Dordrecht: Kluwer Academic Publishers.

Julie, C. (2006). Teachers' preferred contexts for mathematical literacy and mathematics for action. *In Proceedings of the 14th Annual SAARMSTE Conference (pp. 46-55). Pretoria: University of Pretoria.*

Kilpatrick, J. (2001). Understanding mathematical literacy: The contribution of research. *Educational Studies in Mathematics*, 47, 101-116.

Kramarski, B., & Mevarech, Z. (2003). Enhancing mathematical reasoning in the classroom: Effects of cooperative learning and metacognitive training. *American Educational Research Journal*, 40(1), 281-310.

Levenberg, I. (2015). Literacy in Mathematics with "Mother Goose". *Int. J.Learn. Dev*., 5(1), 27-32.

Little, J. (2000). Technology and Mathematics: Is There a Downside? *Mathematics in Schools*. 24(4), 36-38**.**

Mahdiyansyah, R. (2014). Mathematical Literacy of Students at Secondary Education Level: An Analysis Using International Test Design with Indonesian Context*. J. Pendidikan dan Kebudayaan*, 20(4), 452-469.

Mirsal, I. (2016). Mathematical Literacy Level with the Math Teacher Students in the General Diploma Program, Faculty of Education: Analytic Study. *Math Educations Journal*, 19(4), 25-61.

Mumba, F., Chabalengula, V., & Hunter, W. (2006). Quantitative analysis of Zambian High school physics textbooks, syllabus and examination for scientific literacy themes. *Journal of Baltic Science Education*, 2(10), 70-76.

National Council of Teachers Mathematics NCTM (1997). *Standards for Teaching Mathematics*. Reston, Virginia: NCTM

National Council of Teachers Mathematics NCTM (2009). *Guiding Principles for Mathematics Curriculum and Assessment*. Reston, VA: Author.

National Council of Teachers Mathematics NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA.

National Council of Teachers Mathematics NCTM. (2001). *Crossroads in Mathematics*, Reston, VA: Author.

National Curriculum Statement (NCS). (2001). *Curriculum and Assessment Policy Statement GRADES 10-12: Mathematical Literacy*, Cape Town, South Africa.

Nelson, D., Joseph, G., & Williams, J. (2000). *Multicultural Mathematics*. Oxford: Oxford University Press.

Organization for Economic Co-Operation and Development OECD (2000), *Measuring Student Knowledge and Skills: The PISA 2000 Assessment of Reading, Mathematical, and Scientific Literacy*, Oe, Paris.

Organization for Economic Co-Operation and Development OECD (2004**).** *Learning for Tomorrow's World–First Results from PISA 2003*, Oe, Paris.

Organization for Economic Co-Operation and Development OECD (2005**).** *Are Students Ready for a Technology-Rich World? What PISA Studies Tell Us*, Oe, Paris.

Organization for Economic Co-Operation and Development OECD. (2007). *PISA 2006, Science Competencies for Tomorrow's World*. Volume I: Analysis. Paris: OECD.

Rafiepour, A. & Stacey, K. (2009). Applying a mathematical literacy framework to the Iranian Grade 9 mathematics textbook. In M. Tzekaki, M. Kaldrimidou, & C. Sakonidis, C. (Eds.). *Proceedings of 33rd Conference of the International Group for Psychology of Mathematics Education. Vol. 4, (pp. 433– 440). Thessaloniki: PME.*

Roberts, D. (2007). *Scientific literacy/science literacy*. In S. K. Abell & N. G. Lederman (Eds.), Handbook of Research on Science Education (pp. 729–780). Mahwah, NJ, Lawrence Erlbau.

Sadler, T. (2009). Socioscientific issues in science education: labels, reasoning, and transfer. *Cultural Studies of Science Education*, 4(3), 697-703.

Schoenfeld, H. (1992**).** *Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics*. In D.A. Grouws, Handbook of research on mathematics teaching and learning (pp. 165-197). New York:

Shava, F. (2005). *Teaching for Mathematical Literacy in Secondary and High School in Lesoth*, The University of The Free State.

Skovsmose, O. (2004). Mathematics in action: a challenge for social theorising. Philosophy of Mathematics Education Journal. Retrieved *http://www.ex.ac.uk/ ~PErnest/pome18/contents.html (26/8/2018)*

Soobard, R. & Rannikmäe, M. (2011). Assessing student's level of scientific literacy using interdisciplinary scenarios. *Science Educational International*, 22(2), 133-144.

Tai, S. and Hung, J. (2014). Mathematical Literacy of Indigenous Students in Taiwan. *Int. Res. J. Sustain. Sci. Eng*., 2(3), 1-5.

Tanner, H., & Jones, S. (2000). *Becoming a Successful Teacher of Mathematics***.** London: Falmer Press.

Villena, L. (2008). *A study on mathematical literacy of a sample of fourth year high school students and of white collar workers and professionals*. Master thesis, Ateneo De Manila University, Philippines.