American Journal of Sciences and Engineering Research
E-ISSN - 2348 -703X, Volume 4, Issue 3, 2021

The Role of the History of Mathematics in the Teaching of Mathematics with the Approach to History Logarithms

Maryam hadavand[1], mohamad javad eslampour[2], Saeed seyed agha banihashemi[3]
[1,2] *University of teacher training shahid Rajaee*
[3] *School of international realtions.*

Abstract: *The main objective of this paper is to examine the role of history of mathematics in mathematics education with a logarithmic approach. In this paper, we have tried to provide teachers with lessons and ideas in order to teach them before going to class which help them better teaching method and transfer the contents to knowledge for better understanding. To use this model, we chose topics from the titles of the seventh, eighth, ninth, second third high school mathematical books that begin with exponential powers and functions and end in logarithmic terms. Also, in this paper, Shannon entropy method has been used for showing the effectiveness of the influence of history of mathematical in teaching .We use history of logarithm to teach better logarithm.*

key words: *History of Mathematics, Mathematics Education, Logarithms*

I. Introduction

Mathematical education is a branch of human knowledge that has been the subject of scientific circles in recent years, especially in developing countries. A prerequisite for learning mathematics is to make it easy for elementary students to understand the content of the course, and it is worthwhile to appreciate the positive attitude toward mathematics.

One of the most important things for learning mathematical interest is the expression and application of various mathematical and non-mathematical problems. The advancement of mathematical history plays a major role in taking into account the history and practice of mathematics in which it is used in the beliefs of its own students, and in the pursuit of striving, and gradually, It's the right direction to think, and that's the way we should go and treat it as a result.

The mathematical teacher with knowing history of mathematics, based on the activity of students, can teach students how to deal with the problems of the subject, by doing this in a way that the student does the different stages of the problem solving by himself, which makes the student to some extent In the process of solving the problem and the history of the discovery of a theorem, instead of verbally repeating the theorems, science re-establishes itself before it reaches the desired result.

In the following, we introduce a model that uses it to examine the role of history of mathematics in logarithm education.

How to use this model?

This model includes which most teachers can already enter in the curriculum. The teacher views and selects topics that are appropriate for teachers and the needs of students. Resources can be tailored to many different topics and many of the lesson plans are worthy of use. It may even be of interest to teachers or other

 Received- 27-05-2021, Accepted- 10-06-2021

subjects of mathematics. Also, to see the impact of this model on the educational system, we have used the semi-structured interview with the Shannon Entropy method, which is as follows:

II. Shannon Entropy Method:

Shannon considers entropy for any random phenomenon of a probability distribution as follows.

$$E_j = -K \sum_{i=1}^{m} [P_i . l_n P_i] , K = \frac{1}{l_n m}$$

and for calculating the entropy of such phenomena which, due to the uncertainty of the numbers inside the matrix, also includes the indexes, the following formula is presented:

$$E = S \begin{pmatrix} P_1 \\ P_2 \\ \vdots \\ P_m \end{pmatrix}, \sum_{i=1}^{m} P_{i=1}$$

E_j=the entropy of the index j element
m= Number of options

l_n=Logarithmic symbol or natural logarithm
k= The fixed value for entropy modulation is between zero and one.

In this formula, the more Ej means the jet index entropy closer to one, the effect of the index is also reduced to the priority of the options and approaches zero. Therefore, if a phenomenon or index is equal to all alternatives, then the entropy is 100% and One will arrive, and so this indicator will not play any role in choosing the option, which obviously also seems to be.
A decision matrix, as shown below, contains information that entropy can serve as a benchmark for its evaluation.

Table 1-3 Decision Matrix

	X_1	X_2	.	.	X_n
A_1	r_{11}	r_{12}	.	.	r_{1n}
A_2	r_{21}	r_{21}	.	.	r_{2n}
.	.	.	.	.	.
.	.	.	.	.	.
A_m	r_{m1}	r_{m1}	.	.	r_{mn}

We compute the information content of this matrix initially as normalized p_{ij}:
And for Ej we will have the Pij set for each attribute

E_j= - k$\sum_{i=1}^{n} \mathrm{Pi} . Ln(\mathrm{Pi})$

Now the uncertainty or degree of deviation (dj) of the information generated for the index j is this. dj = 1-Ej, finally we will have the weights for (wj):

$$W_j = \frac{d_j}{\sum_{i=1}^{m} d_j}, j = 1,2,\dots,n$$

Note that less weight indicates that the importance of deciding to select that option is negligible. Whatever wj is larger, it means that the effect of that option is greater and is considered to be a more important factor.

Proposed lessons in the activities used are as follows:

Activity	Second year in high school	third year in high school	Seventh year in high school	Eighth year in high school	Ninth year in high school
Sign of power according to Newton			X		
The property of exponential functions	X				
Features of Power	X		X	X	X
Supported growth	X				
Euler and exponential functions review	X		X	X	
Introduction of logarithms	X				
Logarithmic extension by using sequences	X				
Logarithm calculation by using the Neper and Briggs method	X				
Application of logarithmic functions	X				

In the following, we refer to the role of history of mathematics for education in the table above.

III. Calculation of logarithms using Neper and Briggs method

According to the educational model in our country, we provide teachers with notes that can be used to teach this method.

Level: Second High School (Prerequisites: Properties of powers, Logarithms and Definition of Logarithms).

Subject: The purpose of this activity is to give students the opportunity to research the one of ways that can calculate the logarithm.

Tools: a sheet of paper, a calculator (optional).

The original time: A class is designed with homework at home and students have to complete the assignments for this activity.

How to do the activity: The teacher does a brief discussion of the history of the logarithm in the class, then he/she defines the properties and properties of the logarithms and names.

Below is the logarithm in the base 10 which is calculated.
Solutions:
Calculate logarithm 1-at base 10

Log 1

$\log 1 = y \Leftrightarrow 10^{y} = 1$

$10^{y} = 1 \Rightarrow y = 0.$

.log 1 = 0

log 2

$2^{10} = 1024 \approx 1000 = 10^{3} \Rightarrow 2^{10} \approx 10^{3}$

We take logarithms on both sides:

$\log 2^{10} \approx \log 10^{3}$

$10 \log 2 \approx 3 \log 10$

$\log 2 \approx (3 \log 10)/10 = (3 \cdot 1) / 10 = 0.3$

log 2 = 0.3

log 3

$3^{7} \approx 2187 \approx 2 \cdot 1093 \approx 2 \cdot 10^{3} \Rightarrow 3^{7} \approx 2 \cdot 10^{3}$

We take logarithms on both sides:

$\log 3^{7} \approx \log (2 \cdot 10^{3})$

$\log 3^{7} \approx \log 2 + \log 10^{3}$

$7\log 3 \approx \log 2 + 3\log 10$

$\log 3 \approx (\log 2 + 3 \log 10)/7 \approx (0.30 + 3\cdot1)/7 = 0.47$

log 3 = 0.47

log4

$\log 4 = \log 2^{2} = 2 \log 2 \approx 2\cdot(0.30) = 0.60$

4 = 0.60log

log5

$\log 5 = \log (10/2) = \log 10 - \log 2$

$\approx 1 - 0.30 = 0.70$

.Log 5 = 0.70

Log 6

$\log 6 = \log (2\cdot3)$

$= \log 2 + \log 3$

$\approx 0.30 + 0.47 = 0.77$

.Log 6 = 0.77

Log 7

$7^{2} = 49 \approx 50 = 10^{2}/2 \Rightarrow 7^{2} \approx 10^{2}/2$

We take logarithms on both sides:

$\log 7^{2} \approx \log 10^{2}/2$

$\log 7^{2} \approx \log 10^{2} - \log 2$

$2 \log 7 \approx 2 \log 10 - \log 2$

$\log 7 \approx (2 \log 10 - \log 2)/ 2 \approx (2\cdot1 - 0.30)/2 = 0.85$

.log 7= 0.85

Log 8

$\log 8 = \log 2^3 = 3 \log 2 \approx 3 \cdot (0.30) = 0.90$

$\log 8 = 0.90$.

Log 9

$\log 9 = \log 3^2 = 2 \log 3 \approx 2 \cdot (0.47) = 0.94$

$\log 9 = 0.94$.

Log 10

Log 10 = 1

Considering the calculations given by Neuper and Briggs for logarithms 1 through 10, we can make other logarithms based on the above logarithms, for example;

$11^2 = 121 \approx 120 = 4 \cdot 5 \cdot 6$

$2 \log 11 = \log 4 \cdot 5 \cdot 6 = \log 4 + \log 5 + \log 6 \approx 0.60 + 0.70 + 0.77 = 2.07$

$\log 11 \approx 2.07/2 \quad \Rightarrow \quad \log 11 \approx 1.035$.

Of course, in the calculation of the above logarithms performed by Napier and Briggs, there is a small percentage error.For example, when calculating the logarithm 11by calculator, the resulting number is 1.0413927, but the number we obtained is equal to 1.035.We prepare notes for teacher, we should provide notes for students to use this method to teach students the classroom.

The first part:

Get common logarithms for numbers 1 through 10 with base 10.

log 1 = _________

log 2 ≈ __________

To calculate the logarithm2, we need properties of the logarithms, consider the relationship between the following numbers.

$2^{10} = 1024 \approx 1000 = 10^3$

log 3 ≈ ___________

To calculate the logarithm3, we need two approximations and we use the addition operations for power in logarithm , consider the following relation:

$3^7 \approx 2187 \approx 2 \cdot 10^3$

log 4 ≈______________

log 5 ≈ ______________

log 6 ≈ ______________

log 7 ≈ ______________

To calculate the logarithm7, we need to use the power of logarithmic subtraction. Below are the numbers for the numbers;

$7^2 = 49 \approx 50 = 10^2/2$

log 8 ≈ ______________

log 9 ≈ ______________

log 10 = _____________

Part II:

1-Why "=" sign used for logs 1 and 10 and for other logarithms used the "≈" sign?

2- Why is it important to have some important items in order to calculate the logarithms 2, 3 and 7?

3- Use the above method to obtain the logarithm and then obtain the logarithms with the calculator. Why are the values different?

4- Discuss why your values are not accurate. Why are some approximations more suitable than the other? Take examples to justify your commentary. Try to improve your results using relationships.
5-Explain why your approximation is smaller than log 2 and also larger than log 5?
6- In this paper, we tried to perform an activity (computing logarithms using the Neper and Briggs method) by interviewing a class in order to conclude the effect of the logarithmic history on this topic.
7-Given that the logarithmic topic was in the second grade high school mathematics book, with the change of the educational system from the second high school to the tenth, the topic of the logarithm was removed from the tenth grade of that year, and in the third grade of the high school it did not include this inevitably a class from the base We chose the tenth grade and presented the necessary interviews which the results of the interview as follows:

Decision matrix for interviews:

Familiarity of students with the evolution of mathematics and scholars	Sense of replication and pattern selection	Subject knowledge and understanding of concepts	Active Students when Teaching	Design of lateral activities	Understanding concepts	
0	0	0	0	2	2	
0	0	0	2	2	0	
1	0	0	0	0	0	
0	1	1	0	0	0	
0	0	1	0	0	0	
0	1	0	2	0	0	
0	0	1	0	0	0	
0	0	0	2	1	0	
0	0	2	0	0	1	
0	0	0	2	0	0	
0	0	0	0	0	2	
0	1	1	0	2	0	
0	0	0	2	0	0.	
0	1	1	0	0	0	
1	0	0	0	0	2	
0	2	0	1	0	0	
0	0	0	1	0	0	
0	0	0	0	0	1	
0	0	2	0	0	0	
1	0	0	0	2	0	
0	0	0	0	0	3	
1	0	1	0	0	0	
0	0	0	0	1	0	
4	5	9	12	10	11	sum
X_6	X_5	X_4	X_3	X_2	X_1	
0.48	0.56	0.66	0.66	0.56	0.32	E_J
0.52	0.44	0.340	0.38	0.44	0.68	D_J
0.18	0.15	0.12	0.13	0.15	0.24	W_J

The above table shows the results obtained through interviewing the class of 23 students, which, according to the decision-making matrix and the last one, indicate that, from the viewpoint of the participants in the interview, the role of history of mathematical in understanding concepts, and is important on knowledge of students .

IV. Discussion and conclusion:

Research shows that there is a greater relationship between the history of mathematics and mathematical education, and the understanding of students from other sciences will also be greater. The history of mathematics can be effective in make creativity and ingenuity in students. This is done through familiarizing students with the evolution of mathematics and scholars, designing side activities, subject knowledge and understanding of concepts and inner beliefs.

Other results of the research are that history of mathematics can increase interest of students in solving a problem. Functionalize issues, creating understanding , increasing the quality of teaching methods, presenting project assignments and expressing historical narratives from the interest in problem solving by interviewees.

In this study, students also need to create understanding, create self-esteem in students, express math beauty, educate their learners, build their learning skills, and answer their questions, internships, educate their students, and build their confidence in their students by applying the history of mathematics.

V. REFERENCES

1. Swetz, F. (1995). Using problems from the history of mathematics in classroom instruction. In F. Swetz, J. Fauvel, O. Bekken, B. Johansson, & V. Katz (Eds.), Learn from the masters (pp. 25–38). Washington, DC: The Mathematical Association of America.
2. Reimer, W., & Reimer, L. (1995). Historical connections in mathematics Resources for using history of mathematics in the classroom.
3. Man Keung, S., Chi Kailit, L., Ngai Ying,W. (2001). The use of history in the teaching of Mathematics: Theory, practices and evaluation of effectiveness. *Educational Journal*, vol 29, No 1, 1-10.
4. Fauvel, J. (2000). History in Mathematics education, The ICMI study. Created in the United States of America.
5. Carter,B. (2006). The Role of The History of Mathematics in Middle School, A thesis presented to the faculty of the Department of Mathematics East Tennessee State University.