PROBABILITIES AND GENDER - COMPARISON OF COMPREHENSION OF THE PROBABILITIES COURSE BETWEEN GENDERS WITH AND WITHOUT NEW TECHNOLOGIES

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Abstract - Mathematical education in Greece is constantly evolving but there are still some differences in relation to gender and science. With the present study we try to draw conclusions about the understanding of Probabilities which is a branch of applied mathematics. For this purpose, a survey was conducted with 500 students of the Department of Statistics and Insurance Science of the University of Piraeus. They were asked about the probabilities but also about the new technologies. It is noteworthy to mention that, our data show that there is no difference in opinion between the two sexes, regarding the level of difficulty of the probabilities.

Keywords - Probabilities, Gender, New Technologies, Pedagogy, E-education.

I. INTRODUCTION

Nowadays, we notice that women are turning more and more to the positive sciences, a field that used to be dominated by men. Now there is no separation, all scientific disciplines are for everyone. The field of mathematics, Statistics and Probabilities is made up of both women and men. In modern education methods, electronic media are also coming to strengthen the effort to transmit knowledge in these fields (Kotarinou 2004). However, the following questions have arisen: "Does the ability to understand mathematics and its individual branches depend on gender?". "Are new teaching methods achieving their purpose of improving understanding and achieving higher professional goals?".The purpose of this specific work is to draw conclusions regarding whether gender affects the ability to understand and learn the Probabilities course, i.e. whether one of the two genders, "men" or "women", can assimilate the specific course better or equally well , as well as whether electronic educational media contribute to a deeper and more immediate understanding of Mathematics/Statistics/Economics (Boltsi 2019).
For this reason, a questionnaire of thirty questions has been created, which will allow us to reach a conclusion. We have a sample of one hundred people who answered this questionnaire, who have been taught the course of Probabilities or have a background in Probabilities in their school of study. Essentially it is a quantitative research, dealing with the investigation of phenomena with statistical methods and numerical data.

II. THEORETICAL BACKGROUND

Probabilities theory is an axiomatic mathematical theory of measure. In other words, it is the branch of mathematics that deals with the analysis of random phenomena (Papadopoulos 2010). Central to Probabilities theory is the concept of Probabilities, while important are random variables, distribution functions, stochastic processes and events: mathematical abstractions of non-deterministic events, which either occur once or evolve over time. Probabilities theory deals with phenomena whose outcome is influenced by random factors. This means that it cannot be predicted with absolute certainty (Stratigakis 2015, 2016). Thus, the data gathered in a sample survey, the result of a coin or dice toss, the timing of an uncontrolled natural phenomenon, are some of the cases where "randomness" plays an important role and the use of Probabilities theory it is almost inevitable. In summary, the study of the laws that govern random or stochastic phenomena is the main subject of Probabilities theory. Historically, since the beginning of human civilization, there has been an interest in games of chance, which are also a typical example of an experiment of luck (Fasoulopoulos 2022).
However, the development of Probabilities as a special area of mathematics is relatively recent. The ancient Egyptians as early as 3000 BC the "ankle", an animal bone with four sides to play games of chance. This is the ancestor of the well-known dice, which first appeared around 1600 BC. Much later, between the 7th and 10th centuries AD, card-based games of chance (playing cards) appeared in China. Thus from games of chance the idea of the "frequency of occurrence" of certain outcomes and therefore Probabilities began to develop. Nevertheless, systematic studies dealing with random phenomena did not appear until the 15th century. The Italians Luca Paccioli, Niccolo Tartaglia, Girolamo Cardano and especially Galileo Galilei were among the first to calculate probabilities of simple outcomes, related to chance experiments. However, the substantial development of this area began with the work of the

French Blaise Pascal (1623-1662), Pierre de Fermat (1601-1665) and mainly with the writing by the German Christian Huyghens (1629-1695) of the first Probabilities book entitled De Ratiocinates in Aleae Ludo (On calculations in Games of Chance). Then there was a rapid development of this new branch of science after it attracted the interest of many famous mathematicians and other scientists of the time. James Bernoulli (1654-1705), Abraham de Moivre (1667-1754), Pierre-Simon Laplace (1749-1827), Simeon Denis Poisson (1781-1840) are prominent among those who helped develop the theory of Probabilities. , Karl Friedrich Gauss (1777-1855), Pafnuty Chebychev (1821-1894), Andrei Markov (1856-1922), Richard von Mises (1883-1953) and Andrei Kolmogorov (1903-1987).Today, it is a valuable tool for almost all sciences and that is why introductory concepts are taught both in secondary education and in the first years of higher education (Stamos 2022).

III. USE OF NEW TECHNOLOGIES IN EDUCATION

More and more we observe the great influence that new technologies exert in the field of education. Computers, the Internet (World Wide Web) and its pervasiveness do not leave the field of education unaffected. With the development and improvement of technology, scientists have created programs and new methods for its more frequent use in people's daily lives. It is now known that in the modern Greek school there is the presence of electronic media. First, by showing images, videos or apps, interest is generated in the student. In this foreign way, the student pays attention to the time of delivery. Explanations with the help of the teacher and the technology, lead the student to a complete, comprehensible and comprehensive picture of the course. Also, the young person's contact with objects other than books, let alone a computer or tools for course experiments that impose it, differentiates the student's image of the course. Thus, more enjoyable and creative experiences are created (Theologou 2017).The Internet and its enormous growth has given an unexpected boost to all human activities, especially to the sciences and Mathematics. The design and development of education and mathematics cannot be done without taking the Internet into account. Now, the use of electronic media for the courses of statistics, mathematics, economics and Probabilities is essential, because the existence of statistical packages contribute to the calculation of data and the solving of problems much more directly. However, there are also some disadvantages to education using technology. Prolonged exposure to the computer may cause eye problems such as myopia or astigmatism, headaches or, even worse, a brain tumor. In addition, the purchase and maintenance of the computer requires a considerable amount of money.

IV. STATISTICAL ANALYSIS

C500 students participated in this research. 47% (235) are men and 53%(265) are women, and all of them are students in the Department of Statistics and Insurance Science, University of Piraeus. Below, we will see the statistical analysis of the questionnaire responses through the statistical package IBM STATISTICS SPSS (Koutras M., 2004, Bersimis et.al 2016) . We calculated and annotated the frequency tables and charts for the questionnaire questions and performed appropriate statistical tests to examine the factors influencing the ability to understand and learn the Probabilities course in both genders. For the following checks we used a significance level of α=5%.

			Use of Electronic Media in Education and Performance Objectives					Total
			Very little	Little	Moderate	Very	Very much	
Gender	man	Count	10	17	75	75	58	235
		% within Gender	4,3%	7,3%	32%	32%	24,4%	100,0%
		% within Using_New Technologies_in_Training_and_Achieving_Objectives	50,0%	75,0%	51,7%	37,1%	45,8%	47,0%
		% of Total	2,0%	6,0%	15,0%	13,0%	11,0%	47,0%
	woman	Count	10	10	70	110	65	265
		% within Gender	3,8%	3,8%	26,4%	41,5%	24,5%	100,0%
		% within Using_New Technologies_in_Training_and_Achieving_Objectives	50,0%	25,0%	48,3%	62,9%	54,2%	53,0%
		% of Total	2,0%	2,0%	14,0%	22,0%	13,0%	53,0%
Total		Count	20	27	145	185	123	500
		% within Gender	4,0%	5,4%	29,0%	37,0%	24,6%	100,0%
		% within Using_New Technologies_in_Training_and_Achieving_Objectives	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	4,0%	8,0%	29,0%	35,0%	24,0%	100,0%

Table 1 : SPSS frequency table for the question "use of electronic media in education and performance objectives". Gender * Use of New Technologies in Education and Performance Cross tabulation Objectives

			New Technologies and interest					Total
			Very little	Little	Moderate	Very	Very much	
Gender	Man	Count	25	25	60	70	55	235
		% within Gender	10,6%	10,6%	25,5%	29,8%	23,4%	100,0%
		% within New Technologies and interest	55,6%	62,5%	37,5%	46,7%	52,4%	47,0%
		% of Total	5,0%	5,0%	12,0%	14,0%	11,0%	47,0%
	Woman	Count	20	15	100	80	50	265
		% within Gender	7,5%	5,7%	37,7%	30,2%	18,9%	100,0%
		% within New Technologies and interest	44,4%	37,5%	62,5%	53,3%	47,6%	53,0%
		% of Total	4,0%	3,0%	20,0%	16,0%	10,0%	53,0%
Total		Count	45	40	160	150	105	500
		% within Gender	9,0%	8,0%	32,0%	30,0%	21,0%	100,0%
		% within New Technologies and interest	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	9,0%	8,0%	32,0%	30,0%	21,0%	100,0%

Table 2: SPSS frequency table for the question 'use of new technology and interest'

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4,170[a]	4	,383
Likelihood Ratio	4,275	4	,370
Linear-by-Linear Association	1,520	1	,218
N of Valid Cases	500		

Table 3: X2 SPSS table for the question "use of electronic media in education and performance objectives".

Case Control 1:

Ho: "Gender is independent of the opinion regarding whether attending a course using electronic media is more efficient in terms of the learning objectives of the course"

H1: "Gender is not independent of the opinion regarding whether attending a course using electronic media is more efficient in terms of the learning objectives of the course"

The p-value is equal to 0.383 > 0.05=α, so we cannot reject H0.

So gender is independent from the point of view regarding whether attending a course using electronic media is more efficient in terms of the learning object

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2,441[a]	4	,655
Likelihood Ratio	2,459	4	,652
Linear-by-Linear Association	,011	1	,916
N of Valid Cases	500		

Table 4 : X2 SPSS table for the question 'use of new technology and interest'.

Case Control 2:

Ho: "Gender is independent of increasing interest in the course with the use of software"

H1: "Gender is not independent of increasing interest in the course with the use of software"

The p-value is equal to 0.655 > 0.05=α, so we cannot reject H0.

So gender is independent of increasing interest in the course using software.

			Grade of First Probabilities Examination					Total
			under 5	5	6	7	8 and higher	
Gender	Man	Count	105	20	50	35	25	235
		% within Gender	44,7%	8,5%	21,3%	14,9%	10,6%	100,0%
		% within Grade of First Probabilities Examination	48,8%	40,0%	52,6%	58,3%	31,3%	47,0%
		% of Total	21,0%	4,0%	10,0%	7,0%	5,0%	47,0%
	Woman	Count	110	30	45	25	55	265
		% within Gender	41,5%	11,3%	17,0%	9,4%	20,8%	100,0%
		% within Grade of First Probabilities Examination	51,2%	60,0%	47,4%	41,7%	68,8%	53,0%
		% of Total	22,0%	6,0%	9,0%	5,0%	11,0%	53,0%
Total		Count	215	50	95	60	80	500
		% within Gender	43,0%	10,0%	19,0%	12,0%	16,0%	100,0%
		% within Grade of First Probabilities Examination	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	43,0%	10,0%	19,0%	12,0%	16,0%	100,0%

Table 5: SPSS frequency table for the question "degree of first Probabilities examination".
Gender * Grade of First Probabilities Examination Cross tabulation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2,709[a]	4	,608
Likelihood Ratio	2,759	4	,599
Linear-by-Linear Association	,358	1	,550
N of Valid Cases	500		

Table 6 : X2 SPSS table for the question "degree of first Probabilities examination".

Case Control 3:
Ho: "Gender is independent of the grade of the first exam in the Probabilities course."
H1: "Gender is not independent of the grade of the first exam in the Probabilities course."
The p-value is equal to 0.608>0.05=α, so we cannot reject H0.
Thus, gender is independent of the grade of the first exam in the Probabilities course.

V. CONCLUSING REMARKS

The purpose of this work, as already mentioned, is to draw conclusions regarding whether gender affects the ability to learn Probabilities, as well as whether the use of electronic media in education contributes to a deeper understanding of Statistics/Mathematics/Economics and in achieving higher professional goals. Through the questionnaire of thirty questions and the answers given by the sample of one hundred people, we have obtained the necessary data to construct the appropriate diagrams and frequency tables in order to reach conclusions.

It is noteworthy to mention that, our data show that there is no difference in opinion between the two sexes, regarding the level of difficulty of the probabilities. The largest percentage of men in the sample, i.e. 38.3%, answered that the difficulty level of Probabilities is high and the largest percentage of women in the sample, i.e. 49.1%, answered exactly the same. Additionally, the majority of both sexes had to take a Probabilities course a second time in order to pass, with the percentage of men who chose success the second time reaching 29.8% and the female equivalent at 39, 6%. Moreover, in almost all questions, we notice that the majority of men and women chose the same answers at the same time.

At the same time, the hypothesis tests performed on the data from the statistical package IBM STATISTICS SPSS, lead us to the conclusion that the answers are independent of gender. In conclusion, the ability to understand the Probabilities course is not related to gender. Both men and women understand Probabilities to the same degree.

Regarding the use of new technology in the teaching of Statistics, Mathematics and Economics, the largest percentage of men (31.9%) answered that it

contributes moderately to the performance of learning objectives and to a deeper understanding, while the largest percentage of women (41, 5%) answered that it contributes a lot. Regarding whether the use of electronic media offers a comparative advantage in the search for work and in its field, the majority of men (47.8%) and women (43.4%) answered very much. In conclusion, both sexes consider the use of electronic media quite important for their professional career, but at the same time efficient for the achievement of learning goals.

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