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**Professional  
paper**

Paper received: May 12 2020  
Paper accepted: Nov 25 2020  
Article Published: Dec 14 2020

## *The Key Indicators of the Normality of Distribution*

### **Extended summary**

Statistics plays an important role in describing the results of various studies. The basic role of statistical reasoning is to enable generalizations valid for the entire population to be made on the basis of certain quantitative characteristics of the sample. The starting point in making such generalizations is a direct description of the sample, followed by identifying practical and theoretically reliable principles valid for the entire population. Various statistical procedures are used for this purpose, and they are part of many statistical packages such as R, STATA, SPSS, but also those that do not play the primary role in statistical conclusions such as Excel and MatLab. The procedures for which the normality of distribution is the null hypothesis are very common as well. This paper provides an insight into the statistical techniques most commonly used in pedagogical research, which serve as a guide for the researcher in confirming or rejecting the null hypothesis about the normality of the distribution of the population characteristics based on a simple random sample. These are commonly known descriptive methods that allow the researcher to statistically confirm the normality of the characteristics of the entire population.

The first part of the paper describes the most commonly used visual methods: histogram, QQ graph, and scatter diagram, as the most commonly used visual methods that are a necessary part of any research. Visual procedures enable researchers to draw conclusions about, for example, the normalcy of distribution, despite the fact that such conclusions cannot be considered as completely relevant. Apart from the visual procedures, the paper presents

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several statistical tests: Chi-square, Shapiro-Wilk and Anderson-Darling tests, the application of which contributes to the discovery of the essence, which is not possible only by applying visual methods. The correctness of statistical inference is always conditioned by the adequate application of the selected methods and techniques. The application of visual methods, as a direct form of statistical reasoning, must not be the only step in drawing conclusions. Instead, it should serve as an initiative for using statistical tests. In addition, due attention should be paid to the volume of the available sample, given that small samples more frequently pass the normality tests, whereas in large samples, even with small deviations from normality, the null hypothesis would have to be rejected (Ghasemi, Zahediasl, 2012; Oztuna et al., 2006).

The aim of this paper is to present the application of statistical methods in determining the normality of the distribution of the features of empirical pedagogical research. In pedagogical research, intelligence tests, knowledge tests, and many similar tests are used which, although of the discrete type, have certain similarities with the normal distribution, and therefore the normal distribution can be considered an adequate model of such phenomena. For the purposes of this research, we used the data of the existing research on the level of knowledge of students in the initial teaching of geometry to show the application of statistical procedures in confirming the hypothesis of the normality of the distribution of features from which the data originate. In this paper, we performed statistical data processing in the statistical software R. After testing the sample data using the above visual and numerical tests of normality available in the software R, we pointed out the advantages and disadvantages of the applied techniques and methods, as well as the importance of their symbiotic application in drawing conclusions. Often the end result can be a misinterpretation of the research results if only visual or exclusively numerical methods are used in drawing conclusions. The results that confirm the normality hypothesis provide the researcher with a basis for the application of some more advanced techniques and methods such as t-test, ANOVA, and other similar techniques.

**Keywords:** statistics, analysis, normal distribution, visual methods, normality tests.

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