Modeling the rate of penetration (ROP) plays a fundamental role in drilling optimization since the achievement of an optimum ROP can drastically reduce the overall cost of drilling activities. Evolved Extreme learning machine (ELM) with the evolutionary algorithms and multi-layer perceptron with Levenberg-Marquardt training algorithm (MLP-LMA) were proposed in this study to predict ROP. This paper focused mainly on two aspects. The first one was the investigation of the whale optimization algorithm (WOA) to optimize the weights and biases between input and hidden layers of ELM to enhance its prediction accuracy. The other was to adopt a prediction methodology that seeks to update the predictive model at each formation in order to reduce the dimension of input data and mitigate the effect of non real-time data such as the formation properties on the bit speed prediction. The prediction models were trained and tested using 3561 data points gathered from an Algerian field. The statistical and graphical evaluation criteria show that the ELM-WOA exhibited higher accuracy and generalization performance compared with the ELM-PSO and MLP-LMA. Furthermore, ELM-WOA was compared with two well-known ROP correlations in the literature, and the comparison results reveal that the proposed ELM-WOA model is superior to the pre-existing correlations. The findings of this study can help for the achievement of an optimum ROP and the reduction of the non-productive time. In addition, the outputs of this study can be used as an objective function during the real-time optimization of the drilling operation