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Regression Approach to Determining Relationship Between Short Video Viewing Duration and Study Efficiency

Ran Ma

Beijing No.4 High School International Campus, Beijing, China
Caroline.ran.ma@gmail.com

Abstract. Nowadays, the websites of short video developed rapidly, a problem appears gradually at the same time. That is, many students' study efficiency reduces a lot after having a long time viewing short videos. A lot of teachers and parents express their concern about this situation to their kids' academic performance on the Internet, and a theory declares that the short video have a negative correlation between students' study efficiency, appears. Thus, this article is going to study in regression, include simple linear regression and polynomial regression, detect the exact relationship between short video viewing duration and students' study efficiency. It come with a result that viewing short video do have a negative impact on students' study efficiency and academic performance. It is meaningful in regulate students' short video watching and prompt them make a scientific schedule of short video watching duration to avoid being boil by the addiction of short videos. This work should be conducive to students' education.

Keywords: Simple linear regression, Polynomial regression, Short video, Study efficiency

1. Introduction

Regression is a kind of simple method that is very useful to analyze relationships between different things in life. As a main implement of statistics, it is divided into two main core logics: a dependent variable with only one independent variable or multiple independent variables. In this article, the protagonists are two methods with only one independent variable: simple linear regression and polynomial regression.

There are many practical operation examples of regression done by specialists in different areas. For instance, Alan O. Sykes and other researchers work in economics and business; they use regression to help discover and quantify factors that determine income in the labor market. They use simple linear regression to analyze the relationship between only education and income and multiple regression for the situation with a situation that adds a factor—work experience [1]. Besides, in botany, researchers can also use regression to explore the relationship between species and environment, then determine whether this kind of tree is suitable to plant in that area [2]; they can also estimate plant abundance based on pollen percentage [3] or use simple linear regression and geometric mean to analyze the average temperature in biocenosis [4]. The reason for regression being widely used in every area is that it can be practiced in both a very academic field and a very life-like territory. For example, from a pure academic perspective, as Isobe, T. said, linear regression

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is one of the most frequently applied statistical procedures in observational astronomy. It is used to characterize quantitatively an apparent correlation between two properties of a sample of objects; to compare the correlation rate that has been observed with the correlation rate with the astrophysical theoretical prediction; and the probably most important thing is to adjust and quantify the "cosmic distance scale", which is very important for studying the universe's large-scale structure [5]. On the other hand, in daily life, regression can also be used, such as predicting the future energy consumption of a UK supermarket [6]. And this article will find the exact relationship between short video watching duration and students' study efficiency from simple linear regression and polynomial regression's view, which will be full of convincing. This study is beneficial for answering parents' questions about short videos' impact on their children's academic performance and is also giving scientific advice to students' entertainment on the short video, such as TikTok.

This article aims to introduce two methods with only one independent variable: simple linear regression and polynomial regression. The first section will introduce, respectively, simple linear regression and polynomial regression. The second section will introduce one societal problem and use regression analysis and prove one of a relationship inside it. The last section is the summary.

2. Method and theory

2.1. Simple linear regression

Regression is the cornerstone of statistical modeling; it is widely used in exploring the relationship between quantized variables. It can let researchers predicting the quantities of dependent variables based on one or many independent variables and become an obligato helper in subjects such as economy, biology, engineering, and social sciences. Among the many types of regression, simple linear regression and polynomial regression are especially essential because of their simplicity and versatility. These methods can provide valuable perspective toward the relationships between variables, whether they are linear or nonlinear.

Simple linear regression is the most rudimentary and widely used form in regression analysis. It models the relationship between two variables by giving a straight line to the data that have been observed. The equation for the simple linear regression is:

$$y = \beta_0 + \beta_1 x + \epsilon \tag{1}$$

Here, y is the dependent variable (what one can predict), x is the independent variable (predicter), β_0 is the y-intercept (value of y when x=0), β_1 is the slope (the change in y for a unit change in x), and ϵ represents the error term, which illustrates the variation of y that x cannot explain.

Simple linear regression's main target is to find the best-fitting line and let the sum of squared errors between y and x be minimum. People usually use the ordinary least squares (OLS) method to achieve this goal. The simplicity of this method let it be highly interpretable and easy to implement.

One of the advantages of simple linear regression is that it can provide the most clear and virtualized interpretation of the relationship between two variables. For instance, in the ecological, it can be used to analyze the relationship between income and consumption and reflect how the variation of income influenced consumption habits. In the area of health care, it can help analyze the relationship between medicine dose and patient recovery rate. Through quantifying this kind of relationship, researchers can make advisable predictions and decisions based on the data.

However, simple linear regression has its limitations; it assumes there is a linear regression between variables that exists, but this may not always be established in the real world. When the

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relationship is more complex, the straight line may not capture the underlying pattern in the data, and this is where a polynomial regression plays a role.

2.2. Polynomial regression

Polynomial regression expands the concept of simple linear regression by modeling a nonlinear relationship. It does not fit into a straight line but a polynomial curve to the data, the general form of polynomial regression is:

$$y = \beta_0 + \beta_1 x + \beta_2 x^2 + \ldots + \beta_n x^n + \epsilon \tag{2}$$

Here, n represents the degree of the polynomial regression, which determines the flexibility of the model. A higher-degree polynomial allows the curve capture more complex pattern, such as curves, bends, and inflections in the data.

When the relationship between variables is nonlinear, polynomial regression will be useful. For instance, in Physics, it can model the trajectory of a projectile, and the relationship between the time and the height is quadratic. In the economy, it can capture the nonlinear relationship between risk and return. The slight chance of risk may give rise to a big transformation of return. Through combine the higher-order terms, the polynomial regression provides a more accurate expression of data, especially when the simple linear regression cannot capture the potential trend.

One of a main advantage of polynomial regression is its flexibility. It can fix a widely pattern of data, and this lead it becomes a powerful implement of exploring data analyzing. However, this flexibility comes with a trade-off: higher-degree polynomials may cause overfitting, where the model captures noise in the data rather than the real potential relationship. To decrease this kind of situation, researchers must carefully select appropriate degree of the polynomial and verify the model by using techniques such as cross-validation.

3. Method and theory

Simple linear regression and polynomial regression all have its considerable advantage in detecting the relationship between variables. Simple linear regression is good at achieve and explain and conduct as a good starting of understanding the relationship between two variables. While polynomial regression provides more flexibility and accuracy when model a more complex relationship. Overall, the regression analyzing, especially the simple linear regression and polynomial regression, is the powerful and general instrument. Regardless of this relationship is linear or non-linear, these methods provide valuable opinion, and lay the foundation for more complex analyzing. Through take advantage of their benefits, researchers can make wise decision, advance the science knowledge, and solve real challenges from various disciplines.

The question between short videos and students' study efficiency and performance is increasingly receiving widespread attention. Many studies on this issue have also been published. For example, Qin Yao's team [7] and Jian-Hong Ye's team [8] all discovered the addictive phenomena of TikTok in teenagers and exactly detected the reason for teenagers to indulge in TikTok. And Lihong Lu's team found that life now is always boring, and teenagers sought novelty generally, so the short videos, which bring a lot of satisfaction and immersion, have become highly popular among teenagers [9]. There are many horrible consequences if students get addicted to short videos. Tung Lin's team, using a structural equation model, found that the addiction to short videos negatively impact students' creative selfefficacy, which has a positive correlation to the vocational interest.

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Hence, the addiction to short videos has negative impacts, direct and indirect, on both students' creative selfefficacy and their vocational interest [10]. Besides, another group of researchers, who are led by Yuhan Chen, has also found that the short videos significantly decrease users' concentration and let them be more easily distracted, and that is so bad for students. This addiction to short videos on TikTok will give rise to academic procrastination [11]. The most important thing is this kind of addiction has a restriction on people's memory.

First, based on most students' study performance nowadays, watching the short video will occupy a lot of study time, and students cannot leave the mood of entertainment quickly and go to study and review, so most people in society think there is a negative correlation between short video viewing duration and students' study efficiency. To verify this guess, this research decides to collect data and model them in a way that fits the conjecture.

According to the research by Zhang and Zeng, collecting data through a questionnaire survey (Wenjuanxing) analyzes them by hierarchical regression analysis and the PROCESS macro program for SPSS, then tests the mediating and moderating effects. When the result came out, researchers found that the direct effect of smartphone addiction has a considerably negative impact on academic achievement ($b = -0.05$, $p < 0.05$), and this supports the assumption that there is a apparently negative correlation between academic achievement and smartphone addiction among college students [12].

Table 1 list the means, standard deviations, and correlation coefficients for each research and data collection result. The results show that there is a significantly positive correlation between smartphone addiction and academic anxiety ($r = 0.61,\ p < 0.01$), while academic anxiety is shown a considerably negative correlation with academic achievement ($r = -0.11,\ p < 0.01$) [12].

Table 1: Collection about means, standard deviation, and correlation coefficients for variable scores

variable	M	SD	1	2	3	4
Smartphone addiction	2.86	0.72	1			
Academic anxiety	2.43	0.77	0.61**	1		
Sense of academic control	3.59	0.53	-0.23**	-0.47**	1	
Academic achievement	3.23	0.52	-0.05*	-0.11**	0.24**	1

Note: *p<0.05, **p<0.01 [12]

When focus on two variables: academic anxiety and smartphone addiction, Figure 1 shows a higher addiction with a higher academic anxiety, which will reflect this research protagonist: addiction of smartphone such as short videos will contribute to a lower study efficiency.

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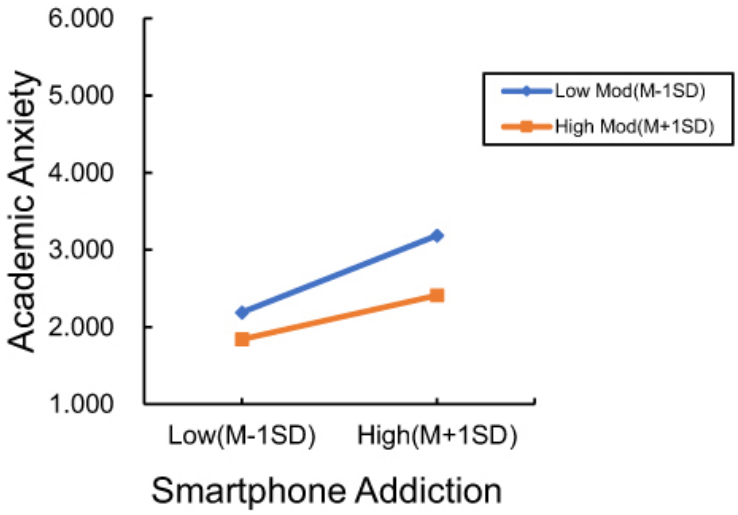

Figure 1: Regression result to relation between academic anxiety and smartphone addiction [12]

4. Conclusion

As a fundamental and general statistical implement, regression analysis is verified as very useful in detecting the relationship between short video viewing duration and students' study efficiency. This research successfully quantifies the impact of short videos on academic performance. The regression model shows too much viewing of short videos has an obvious negative correlation between students' study efficiency and highlights how long periods of exposure to such content can damage learning habits, reduce attention duration, and hinder academic progress. The use of regression analysis lets people not only ensure this relationship but also model in nuance, too. Simple linear regression provides direct understanding of the relationship between short video viewing duration and students' study efficiency, and polynomial regression captures more complex non-linear models that may be neglected. These findings emphasize the importance of using reliable tools such as regression to analyze real-life phenomena, especially when it has big impacts on education and in the digital consumption era. Look forward to the future; the opinions gotten from regression analysis can provide information on managing screen time and promote students forming a healthier digital habit. Educators and parents can take advantage of these findings to make guidelines that balance entertainment with academic responsibilities. Studies in the future should use regression to explore other factors that influenced study efficiency continuously and design intervening measures to induce the negative impact of addiction to short videos within a maximum limit. And at the same time, enhance the potential benefits of educational content at a maximum limit, too.

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