**Methodology**

The purpose of this analytical study was to determine the impact of district-level instructional expenditures (independent variable) on student achievement scores (dependent variable). The independent variable was defined as district-level per-pupil total instructional spending for regular education and the percentage of the students identified as economically disadvantaged as reported by the State of Tennessee. The dependent variable was defined as student achievement as measured by Tennessee ACT scores as published by the State of Tennessee. The population of this study was all 119 public K-12 school districts in Tennessee that have high school students. The study utilized data from 119 public school districts in Tennessee. I have seven years of data but for the purpose of this exercise we will limit the results to one year – 2010. The proportional weights were obtained for each year by multiplying the attendance in each district by n/N, where n is the number of districts and N is the total number of attendances. The proportional weights allowed the original sample size (*n* = 119) to be preserved as well as the proportions between district attendances. The cases were weighted by using the Weight Cases command under Data in SPSS. OLS regression was selected after applying the weights.

**2010 Interpretation: Overview**

The regression results indicated that *R*2 = 79.3%, *F* (2, 118) = 222.359 (p < 0.01) of the variation in the composite district ACT scores was explained by per pupil instructional expenditures and percentage of economically disadvantaged in these districts. The regression coefficients showed that both the percentage of economically disadvantaged and per pupil expenditures statistically significantly predicted district composite ACT scores, β = -.946 (p < 0.01) and β = .128 (p = .010), respectively.

**Model for the 2010 Data - Analysis**

The regression model was given by the equation *Y =* 22.463 + 0.00039*X*1 -8.355*X*2, where *Y* denoted ACT score, denoted per-pupil instructional expenditure for regular education and denoted percentage of economically disadvantaged. A population size of 119 was sufficient for regression analysis. Theoretically, if the sample size was greater than 30 it was considered a large sample (Suter, 2006). Other researchers were more stringent and reported that when *N* was below 50 the validity of the results was questionable (George & Mallery, 2009). While there was not a standard rule for an acceptable population size for multiple regression analysis, an *N* value of 119 was adequate for research purposes.

The adjusted *R*2 value of the model was obtained at 0.790. This means that 79.0% of the variations in the ACT scores can be explained by the variations in the explanatory variables, per-pupil instructional expenditure for regular education and percentage of economically disadvantaged. For example, the adjusted *R*2 value of the 2010 data was obtained at 0.790. This means that the explanatory power of the model was 79.0%. In other words, 79.0% of the variations in the dependent variable can be explained by the variations in the independent variables. The remaining 21.0% variations in the dependent variable were left unexplained.

The *F* value for the overall significance of the model was 222.359 and the corresponding significance value was 0.000. This means the model was statistically significant. While the explanatory power of the model left 21% unexplained, the model was a valid model because of the overall statistical significance. The *F* value of the model was 222.359 and the corresponding significance value was 0.000. This means that the model was statistically significant in explaining the variations in the ACT scores. If the significance value was less than 0.05 the social science research community accepts the model was significant at 5% level of significance (Christensen & Johnson, 2007; Suter, 2006). Statistically significant models were helpful to interpret and gain insight into the data.

The adjusted *R*2 value of the model was 0.790. This means the explanatory power of the model was79.0%. That means, 79.0% variations in the ACT scores can be explained in terms of the variations of the explanatory variables considered in the model. An explanatory power of 79.0% indicated that 21.0% variations were left unexplained. There may be other variables that influenced the dependent variable and were not included in the model. Inclusion of such variables may increase the explanatory power. There was not a standard classification for low, medium, and high *R*2 values. With this data and situation, the *R*2 values should be considered significant because each value represented more than 2/3rd of the reported variation in ACT scores.

Another important concern to recognize was the 21.0% (=100 – 79.0) variations in the ACT scores were left unexplained. There may be other variables that influenced the dependent variable, which are not included in the model. Inclusion of such variables in the model could increase the explanatory power.

The *F* value was reported to be statistically significant if it was greater than the corresponding critical value. Standard *F* tables were available for finding the critical value. The critical value of the *F* statistic was obtained on the basis of the degrees of freedom and significance level. In the present problem, the degrees of freedom of the *F* statistic were 2 and 116. For the significance level α = 0.05, the critical value was 3.0745. This critical value was obtained by using Excel function FINV (0.05, 2,116). If *F* value was greater than the critical value it was considered as high.

An alternative approach to examine whether the *F* value was significant was by using the significance value. If the significance value was less than the significance level, then the *F* value was significant. This was the method used by this researcher and all *ρ* values were reported at < 0.01. All *F* values were reported as significant.

The researcher considered a comparison of two significant *F*-values. In this case, higher *F* value indicated higher statistical significance of the model. In the present context the higher *F* value indicated higher statistical significance of the model in the following sense. The *F* value = 222.359 was high compared to the critical value 3.0745. This higher *F* value indicated higher statistical significance of the model.

The individual regression coefficients of the model were interpreted as follows. The intercept component of the model was 22.463. The *t* value for the intercept component was 41.297 and the corresponding significance value was 0.000. This means the intercept component of the model was statistically significant. The intercept component was the fixed part of the model (the Y value corresponding to = 0 and = 0). This means the ACT score that can be produced with no influence of the per-pupil instructional expenditure and percentage of economically disadvantaged was 22.463.

The regression coefficient of the explanatory variable was 0.0039. The *t* value for this coefficient was 2.632 and the corresponding significance value was 0.010. This means the variable, per-pupil instructional expenditure, was statistically significant in explaining the variations of ACT scores. Even though the magnitude of the influence of this explanatory variable may seem to be small, the variable cannot be dismissed from the model because of the higher statistical significance.

The regression coefficient of the explanatory variablewas obtained as -8.355. The negative sign indicated the negative influence of this variable on the dependent variable. The *t* value for this coefficient was -19.524 and the corresponding significance value was 0.000. This means that the variable, percentage of economically disadvantaged, was statistically significant. The coefficient value -8.355 indicated that a 100% decrease in the percentage of economically disadvantaged will produce an 8.355 point increase in the ACT score. This means the presence of increased percentage of the economically disadvantaged adversely affected ACT scores. In other words, a 12.0% decrease in the percentage of economically disadvantaged, will produce a 1 point increase in the ACT score.

The overall conclusion about the model can be described as follows. The model was a statistically significant model to explain the variations in the ACT scores. Of the two explanatory variables considered, percentage of the economically disadvantaged was more significant compared to the other variable, per-pupil instructional expenditure. The explanatory power of the model was considered satisfactory. The explanatory power (79.0%) leads to the conclusion that there were excluded variables. More explanatory variables could be included in the model to reduce the unexplained variations and to obtain a better model with higher explanatory power.