Determinants of English Remedial Education through Web-based Learning

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Abstract: - Due to the rapid decrease of population of the younger generation in recent years, Japanese universities/colleges, especially privately-owned universities/colleges, have to lessen the signs of tension in entrance examinations to guarantee their quotas. Students with academic proficiencies at various levels are accepted and remedial education to freshmen carries significant implications for Japanese higher education. This paper reports a preliminary research on factors which may influence the effectiveness of English remedial education course study. Multiple regression analysis is conducted on basis of data collected from 121 sample students. An optimized model for the prediction of changes in students’ English scores is postulated and diagnosis is carried out to clarify those aspects affecting the consequence. The result indicates that student’s total academic performance, their willingness to get involved in intercultural communication and their computer operation skills tend to influence the outcome most.

Key-Words: - multiple regression analysis, remedial education, prediction model, web-based learning,

1 Introduction

Remedial education has become an indispensable component of higher education in certain countries/areas. According to the National Center for Education Statistics in USA, 72.8% of American degree-granting institutions offered remedial services through 2006-2007 [7]. Hoyt further proved that remedial education functions as a significant factor closely related to student attrition rates in community colleges of America [3]. In Japan, government attention has been given to the issue of remedial education in recent years. Owing to the considerable decrease in the population of younger generation, Japanese universities/colleges have to accept “addition of students who need support in the general education classroom” [5], and frameworks for remedial education were established by central government MEXT to provide follow-up supports to these students with learning disabilities [6].

The objective of remedial education is to improve the quality of practice in postsecondary developmental education and provide students with more chances to realize potential successes in academic learning. Since the course often parallels the normal curriculum study for graduation in Japanese universities/colleges, e-learning is employed as an effective tool to lessen the burden of teachers. Extensive researches have been conducted to demonstrate the effectiveness of e-learning [1], but few have ever attempted to examine remedial course from a comprehensive perspective and investigate what on earth contributes to the improvement of students’ academic performances in an e-learning environment. The same school resources can “produce many educational outputs” [4]. Therefore, it is crucial to figure out those complex non-causal relationships potentially existing among those factors which lead to the various education productions. This paper establishes the study about English remedial education for Japanese learners on the assumption
that individual commitment to academic learning activities, intercultural communication and computer operation skills are closely related to the outcome of English remedial education course through a web-based learning tool. They serve as determinant variables in the optimized model for predicting the outcome of remedial education and the fitness of the equation postulated through multiple regression analysis is also examined.

2 Problem Formulation
The theory which lays the ground for this study is the linear regression analysis method proposed by Karl Pearson. The outcome of English remedial education \( W_i \), which reflects students’ score changes after the course study, functions as the dependent variable, with factors of related aspects as the independent variables \( Y_i \). We suppose a quasi-linear relationship exists in this framework and the predictive regression model should follow the typical monomial equation:

\[
W_i = f(Y) = \beta_0 + \beta_1 Y_1 + \beta_2 Y_2 + \ldots + \beta_i Y_i + \epsilon_i \\
(1)
\]

Dependent variable \( W_i \) indicates the score change of the \( i \)-th sample student after remedial education course study and \( Y_i \) refers to the \( i \)-th independent variable which correlates maximally with \( W_i \). \( \beta_i \) works as the determinant coefficient of the \( i \)-th independent variable and is figured out through the method of least squares. Residual \( \epsilon_i \) is an observational error between the expected score change and the observed score change and \( \beta_0 \) is the intercept of the straight line. Since our purpose in our current study is to postulate an equation for preliminary prognosis, we ignore the residual \( \epsilon_i \) temporarily and leave the research of this exponent to future work.

As mentioned above, there are noticeable researches on how to improve the effectiveness of English remedial education in Japan. But most of them inspect the issue from a single scope with limitation of persuasiveness. As far as we are concerned, there is seldom any practical study on the prediction of the outcome of English remedial education from a synthesized perspective. Education production outcome \( Y \) does not depend on students’ academic attainments only [3]. Students’ cognitive beliefs and non-pedagogical relevant factors also exert critical impacts on the output of their learning activities. In the case of English remedial education, independent variables \( Y \) consist of a combination of certain factors, including students’ total academic commitments \( H \), correct understanding about intercultural communication \( J \) and desirable proficiency in computer operation skills \( L \). Academic relevant information includes students’ total motivation, attitudes and commitments towards all learning activities. In summary, the post-course score change \( W \) in English remedial education is caused by a sophisticated process which holds the following three vectors in its synergetic action: total academic commitment \( H \), correct understanding about intercultural communication \( J \) and admirable computer operation skills \( L \).

\[
W = f(Y) = f(H, J, L) \\
(2)
\]

We assume that the three vectors all have a positive impact on students’ test score changes.

3 Data

We collected 121 effective samples in 2007 from the freshmen of Computer Design Faculty in Nishinippon Institute of Technology, Japan. The data is made up of three inquiries and student management record provided by the university: (1) Total academic performances (student management record): including school attendance rates, average scores of all subjects in the first semester, performances in the web-based self-learning activities \( H_i \); (2) Inquiries on their motivation, attitudes and commitments towards learning: including their learning strategies, response towards the assessment received from teacher, their anxiety degrees about credits for
graduation, et al. (H2); (3) Inquiries on their understanding about intercultural communication and their involvement in it (J); (4) Inquiries on computer operation skills and their inclination to employ computer as a tool in their learning (L). Both the first and the second items are considered explanatory variables belonging to the same category (H) in this study. Thus, the three vectors in equation (2) are adequately reflected in the data collecting process.

Table 1  Statistics of observed score changes

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>average</td>
<td>9.5</td>
</tr>
<tr>
<td>standard residual</td>
<td>1.01</td>
</tr>
<tr>
<td>standard deviation</td>
<td>11.1</td>
</tr>
<tr>
<td>minimum</td>
<td>-28</td>
</tr>
<tr>
<td>maximum</td>
<td>36</td>
</tr>
<tr>
<td>sample</td>
<td>121</td>
</tr>
</tbody>
</table>

Students are supposed to carry out self-study through a web-based learning system called ASP (Active Server Pages) (Fig.1). The e-learning tool aims at an improvement of students’ basic knowledge (both grammatical rules and vocabulary) about English which should have been mastered during their middle school and high school study. The purpose of this course is to help them compensate for their deficiencies in English study as soon as possible so that they can keep up with the standard university/college curriculum education. Both pre-course test and post-course test were held in order to figure out the exact changes. The outcome of their self-study is used as an index to examine the effectiveness of this online remedial course.

As implied in Table 1, the average score change in the post-course is 9.5 points, which stands for a certain progress in students’ English proficiencies. Although most changes happened within a scope of 0 ~ 20 points (Table 2), the gap between the minimum score change and the maximum score change reaches 64 points. As an inevitable phenomenon, pre-course test score turns out to be the most fundamental determinant in post-course score change -- students whose pre-course test scores are higher tend to show a non-significant change in their post-course test performance (Table 3). This tendency once more strengthens our doubt for this study: what are the other determinants contributing to the score changes except for students’ pre-course test scores?

4 Result

We conducted multiple regression analysis repeatedly by using excel in order to find out those independent variables which help construct the optimized model for the prediction of post-course score changes. According to the criterion suggested by Ueta [8], multiple regression analysis should be based on the following equation. The parameter with the largest p-value is deleted each time until only one parameter is left:

\[
\hat{\mathbf{W}}_i = 1-(1-R^2)(n+k+1)/(n–k-1) \]

(3)

\( R^2 \) is the determinant coefficient and stands for the contribution ratio. \( k \) is the number of independent variables (number of parameters used each time to conduct the analysis). \( n \) stands for number of samples which is 121 in this study.

Table 4 shows the individual coefficient of each independent variable which helps create the maximum \( \hat{\mathbf{W}}_i \) (0.525). That means, the equation proposed can interpret 52.5% of the dependent variable \( \hat{\mathbf{W}}_i \). All of 12 determinant variables
demonstrate a positive relationship with the post-course score changes except the specific item ---- pre-course test score. The improvement of any determinant variable leads to a certain increase in the figure of their post-course test score. Most p-values for the determinant variables are under .01 other than two parameters – “credit anxiety”(U) and “willingness to improve one’s computer operation skills”(E).

Consequently, we infer the following formula as the optimized model for the prediction of students’ score changes ($\hat{W}_i$) after the English remedial course study through web-based learning:

$$
\hat{W}_i = -17(I) + 0.483 * T_i + 0.736 * A_i \\
+ 2.17 * M_i + 1.21 * U_i \\
+ 2.31 * F_i + 1.56 * C_i \\
+ 1.97 * Q_i + 2.28 * G_i \\
+ 1.74 * O_i + 2.19 * S_i \\
+ 1.11 * E_i + 1.51 * D_i
$$

In order to testify the fitness of equation (4), we intended to confirm the correlation between the expected score changes ($\hat{W}$) and the observed score changes of each sample student. According to the compendium method proposed by Ueta, correlation among the factors is believed to exist if the following equation functions [8]:

$$
R^2 > \frac{4}{(n+2)} \quad (5)
$$

Table 6 Correlation between observed score changes and expected score changes

In this study, the sample number (n) is 121. Therefore, we expect $R^2$ to be more than 0.033 in order to assure the correlation. We figured out the expected score changes $\hat{W}$ for all students and compared them with their respective observed score change. The result suggests that $R = 0.786$ (Table 5) and $R^2$ turns out to be 0.617 (Table 6), much higher than the specified value 0.033. Therefore, we can definitely make the conclusion that there is an extremely strong correlation between the observed score changes and the expected score changes calculated by using the optimized model postulated above.
Table 7  Approximate curves for observed score changes and expected score changes

Table 8  Approximate curves for observed score changes and standard residuals

Table 9  Impact degrees of independent variables

Table 10  Impact degrees of different groups of determinant factors

The impact degree ($V_i$) of each independent variable is another important exponent for the measurement of each factor’s impressiveness. It helps clarify the question we hold in mind that what on earth causes the differences in students’ score changes. The impact degree ($V_i$) is calculated according to the following equation:

$$V_i = f(R, B) = R_i \times B_i$$  \hspace{1cm} (6)

$R_i$ is the coefficient value for the respective determinant variable listed in Table 4. $B_i$ is the range of the parameter in the original data, by subtracting the minimum value ($Z_{ib}$) from its maximum ($Z_{iy}$):

$$f(B_i) = Z_{iy} - Z_{ib}$$  \hspace{1cm} (7)

Thus,

$$V_i = R_i \times (Z_{iy} - Z_{ib})$$  \hspace{1cm} (8)

Table 9 signifies the impact degrees of all the independent variables included in the optimized model. Except for the item of pre-course test score (T), the average score of total subjects (A) turns out to be another noteworthy determinant, while other independent variables show no remarkable difference in their impacts on the dependent variable.

As we manifested in equation (2), the post-course score change in English remedial education (Y) is a
combined function of total academic commitment (H), correct understanding and active attitude toward intercultural communication (J) and admirable computer operation skills (L). Likewise, the indexation of determinants H, J and L is also an outcome achieved by the coordination of several independent variables respectively. The synthesized operation of the independent variables in the optimized model can be interpreted as in the following equations:

\[
H = (A, M, U) \quad (9)
\]
\[
J = (F, C, Q, G) \quad (10)
\]
\[
L = (O, S, F, D) \quad (11)
\]

In this study, we treat T as a reference rather than a common independent variable and list it as a completely separate independent index which presents a negative correlation with the dependent variable (Ŵ). Table 10 suggests the impact degrees of different aggregations of determinant factors. H appears to be most substantial in its impact degree with J in the middle and L the slightest.

5 Conclusion
Remedial Education is an urgent demand of the rapid development of higher education. It turns out to be a menace to the quality of higher education when students’ academic proficiencies are not to be pulled up to a desirable level within a limited time span. How to increase the effectiveness of remedial education is a common problem that more and more countries have to face.

Since remedial education course parallels the normal curriculum study in Japanese colleges/universities, it requires a most dramatic efficacy in its implementation process. Education production is an indication which represents the consequence of the complex function of numerous factors. The key component in the solution of this problem is to spot those determinants related to the result of remedial education and figure out how they contribute to the cause.

English remedial education is exclusively determined by factors of three aspects – students’ total academic commitment, correct understanding and active attitude toward intercultural communication and admirable computer operation skills. Rather than how much time they spend with the online learning tool, how much they are willing and determined to get involved in the total school learning activity seems to influence their post-course test performance most seriously. Although cognitive factors are striking in our analysis, student’s computer operation skill is a third index explicating the prediction model (3). It may not demonstrate distinctness in other education environment where computer is not applied as the principal learning tool.

References:


