

Is the TEAS V predictive of early nursing school success?

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## Introduction

### Background

A critical component of success in nursing school is academic achievement, and one essential determining factor of academic achievement is academic preparation. In any nursing program, PN, ADN, BSN or diploma program, a certain minimum level of academic competency and skill is required for success. Therefore, it is necessary to consider students' academic preparation when making admissions decisions and evaluating nursing school success. It is important to keep in mind that a score on one test is not representative of all skills needed to be successful in nursing school. Thus, it is recommended that other academic factors be considered when making academic decisions such as students' GPA, courses taken, etc. Nonacademic factors may also be accounted for in a comprehensive approach to making admissions decisions.

The main purpose of the Test of Essential Academic Skills (TEAS) V assessment is to assess academic preparedness in the areas of reading, mathematics, science, and English and language usage. If the TEAS V is used to make decisions regarding whom to admit into a nursing academic program, institutions should use the test results in conjunction with other admission criteria to determine whether or not to admit an applicant. In other words, the TEAS V should not be used as the sole determining factor as to whether or not an examinee is admitted into a program. Furthermore, it is recommended that schools use the overall score from the TEAS V, instead of individual subtest scores, when evaluating an applicant (Wolkowitz, 2011).

ATI's Fundamentals of Nursing assessment is a standardized test that is typically administered in a Fundamentals of Nursing course which is most often taken during the first year of study. As such, performance in Fundamentals is a reasonable proxy for early nursing success. Student performance on both the TEAS V and Fundamentals tests can readily be compared by matching ATI student identification numbers.

This report provides evidence to support the predictive validity of the TEAS V as an indicator of early nursing school success thereby supporting its use as a tool in the admissions process. As such, three related research questions are addressed which are as follows: Do TEAS V test scores correlate with early nursing school performance as measured by the Fundamentals test?; How accurately can the TEAS V predict early nursing school success?; and Do successful early nursing school students perform differently on the TEAS V test than unsuccessful students?

## Data & Methods

Data were obtained for RN and PN students that had test scores for both the TEAS V test (form B) and either the RN 2007 Fundamentals test (form B) or the PN 2008 Fundamentals test. Retake scores were not included in the dataset; i.e., scores that represented a student's second or third attempt were removed for the following analyses. No restrictions were used in selecting data with respect to test date or minimum score on a test. That is, all students that had score information for the TEAS V and Fundamentals were included regardless of when they tested or what scores they received. Data was not restricted to a predefined range of scores as doing so may influence the results of subsequent analyses. However, students that did not complete at least 80% of either test were not included. For RN students, there were 8,198 cases that fit these criteria and for PN students, there were 4,899 cases. The RN students represented 509 institutions while the PN students came from 393 different schools.

In addition to percent correct scores, students' scores on both test were categorized by academic preparedness categories for the TEAS V exam and proficiency levels for the Fundamentals exam. A set of criterion-referenced cut scores were developed for each of these exams during their respective national cut score studies in which nurse educators nationwide participated. During these studies, the definitions for the TEAS V categories were developed and the proficiency level definitions for the series of exams that includes the Fundamentals of Nursing exam were approved. ATI recommends that institutions choosing to use one of the established benchmarks should read the definitions and select the most appropriate benchmark for their institution. Table 1 on the next page displays the TEAS V academic preparedness categories and Tables 2 and 3 display the proficiency levels for the RN and PN Fundamentals tests, respectively.

Several analyses were conducted to evaluate the relationship between the TEAS V and the Fundamentals test scores and proficiency levels. The first goal was to determine if there was a significant correlation between the two assessments. However, a correlation coefficient is limited as a statistical index for validity evidence in that it represents an average prediction based on content or skill similarity. As such, proficiency level 2 on the Fundamentals tests was used to define success or failure in early nursing school and further analyses were conducted to evaluate the predictive accuracy of the TEAS V as well as performance differences on the TEAS V for successful and not successful students. Proficiency level 2 on the Fundamentals was only chosen for the purposes of this paper and

ATI does not necessarily recommend it as a cut score for all institutions. That is, institutions should decide which cut score is most appropriate for their students and their institution's specific needs.

Table 1. *TEAS V cut scores for each academic preparedness category*

TEAS V Academic Preparedness Categories	Percent Correct
Developmental	< 41.3
Basic	41.3 – 58.6
Proficient	58.7 – 77.9
Advanced	78.0 – 90.6
Exemplary	>= 90.7

Table 2. *RN Fundamentals cut scores for each proficiency level*

RN Fundamentals Proficiency Level	Percent Correct
Below Level 1	< 58.3
Level 1	58.3 – 66.6
Level 2	66.7 – 79.9
Level 3	>= 80.0

Table 3. *PN Fundamentals cut scores for each proficiency level*

PN Fundamentals Proficiency Level	Percent Correct
Below Level 1	< 53.3
Level 1	53.3 – 61.6
Level 2	61.7 – 73.2
Level 3	>= 73.3

## **Study 1: Do TEAS V test scores correlate with early nursing school performance as measured by the Fundamentals test?**

If the TEAS V is intended to measure academic achievement that is critical to success in early nursing school, and if early nursing school success can be reliably measured by scores on the Fundamentals test, then there should be a relationship between TEAS V test scores and Fundamentals scores. Evaluating the statistical relationship between these two test scores provides validity evidence for using TEAS V test scores as part of schools' admissions criteria. Pearson correlation coefficients were calculated to evaluate this relationship.

### **RN Students**


Correlation indices indicated that TEAS V scores for RN students are significantly related to performance on the Fundamentals test,  $r = 0.459$ ,  $p < .0001$ . This relationship was statistically significant suggesting that a relationship exists in the population and can be interpreted as a medium to large effect size (Cohen, 1988). The squared correlation coefficient,  $r^2$ , (also referred to as the coefficient of determination) indicates that 21.1% of the variance in RN Fundamentals test scores can be explained by variations in TEAS V test scores.

### **PN Students**

Correlation indices indicated that TEAS V scores for PN students are significantly related to performance on the Fundamentals test,  $r = 0.455$ ,  $p < .0001$ . This relationship was statistically significant suggesting that a relationship exists in the population and can be interpreted as a medium to large effect size. The squared correlation coefficient,  $r^2$ , indicates that 20.7% of the variance in RN Fundamentals test scores can be explained by variations in TEAS V test scores.

### **Discussion**

The correlation coefficients reported in this paper are consistent with those previously reported in Wolkowitz & Kelley (2010). The magnitudes of these correlation coefficients are invariably impacted by several factors. First, since the sample of students included in this analysis consisted only of students that were actually admitted to a nursing program, the range of test scores is not as low as it may have been had the TEAS V scores for those not admitted been included in this study. In other words, students may be selected to programs, in part, based on their TEAS V test scores; thus, students with very low test scores may not be as frequently admitted. If these students were admitted into a program then the correlation between admissions test scores and Fundamentals test scores would likely be higher as their chances of being successful in early nursing school would also tend to be



lower on average. In general, this tends to be an issue in any situation where an assessment tool that is intended to measure academic skills is used to help make decisions about which students to admit to a program (Whitney, 1988).

Second, from a statistical standpoint, a correlation cannot exceed the square root of the product of the reliabilities of the two tests. The reliability of TEAS V test scores has been estimated to be 0.92 while the reliability for the Fundamentals PN test is around 0.71 and 0.63 for the RN test. Therefore, the correlation between the TEAS V and the PN test will not be greater than 0.81 and will not exceed 0.76 for the RN test. Given these restrictions, the correlation coefficients described provide reasonably strong evidence for criterion related validity.

Given these limitations, the correlation coefficients presented in this report are positive and are considered to be medium to large effect sizes; these findings provide criterion-related validity evidence for using TEAS V test scores to gauge Fundamentals performance. Furthermore, these coefficients are slightly better than another commonly used admissions test. Specifically, the ACT test purports a median correlation of 0.41 with first year GPA (Sawyer, 2010). While these coefficients are not directly comparable given different criterion measures as well as different methods from which the coefficients were obtained, it may still be used as a relevant point of reference in understanding the results presented here. Given this context, the TEAS test appears to perform quite well as an indicator of early nursing school success.

Finally, a correlation coefficient is limited as a statistical index for validity evidence in that it represents an average prediction based on content or skill similarity. However it doesn't reflect the accuracy of admissions measures in identifying students that will be successful in nursing school which inevitably is where the real value lies from an educator's perspective. This type of prediction accuracy needs to be modeled directly. As mentioned previously, success was defined, for the purposes of this paper, as obtaining a score in or above proficiency level 2 on the Fundamentals test and statistical models were derived to model these predictions.

## Study 2: How accurately can the TEAS V predict early nursing school success?

As mentioned previously, Fundamentals test scores were recoded as a binary variable that indicated success or non-success (1,0) in early nursing school. This variable was defined by the second proficiency level which is the level that describes an adequate level of knowledge to meet NCLEX standards. For RN students, a score of 66.7% or greater is needed to be placed at proficiency level 2 and considered “successful”. For PN students, a score of 61.7% or greater is needed to be at proficiency level 2 and considered “successful”. In order to evaluate the accuracy of the TEAS V in identifying students that were successful in nursing school, a prediction model was derived using logistic regression analyses. However, as a preliminary step, proportions of students at each TEAS academic preparedness categories were calculated for the successful and unsuccessful groups of students.

### RN Students

Table 4 below displays frequency counts (and percentages) of the number of students that were successful on the Fundamentals test by TEAS performance category. Figure 1 is a graphical depiction of the percentages from Table 4. As would be expected if the TEAS V is predictive of early nursing school success, there was a larger proportion of students that were in the bottom TEAS performance category that were not successful on the subsequent Fundamentals test than in any of the other performance categories. As TEAS performance categories increase towards *Exemplary*, the proportions of students that were deemed successful also increase.

Table 4. *Frequencies (and percentages) of students in each TEAS V performance category by success on the RN Fundamentals test defined by Proficiency Level 2 or greater*

TEAS V Academic Preparedness Category	Not Successful (< prof level 2)	Successful ( $\geq$ prof level 2)
Developmental	84 (76%)	27 (24%)
Basic	739 (60%)	495 (40%)
Proficient	1563 (33%)	3134 (67%)
Advanced	274 (13%)	1771 (87%)
Exemplary	6 (5%)	105 (95%)

Note. Percentages were calculated by row such that each row totals 100%.



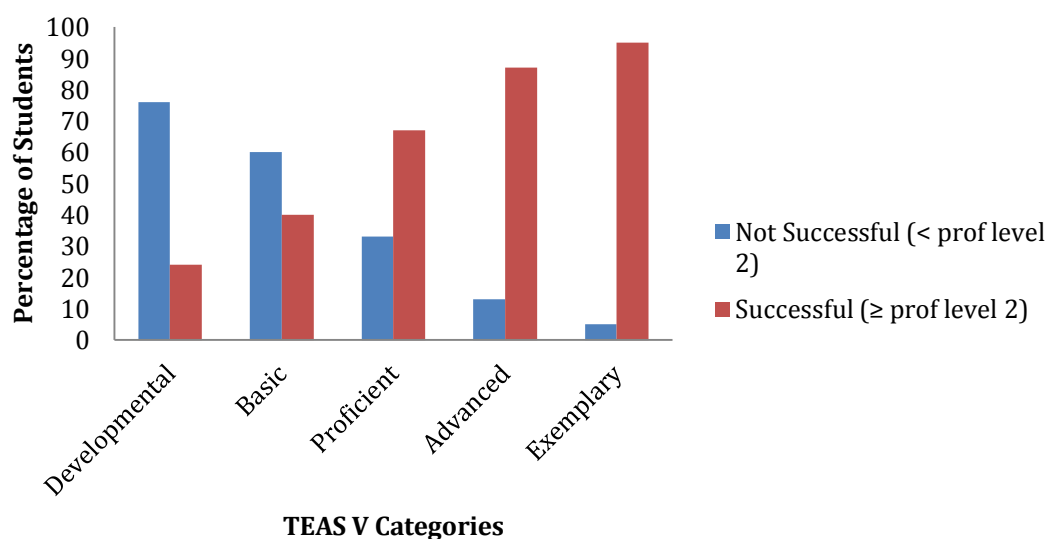


Figure 1. Percentages of students in each TEAS V preparedness category by success on the RN Fundamentals test.

## PN Students

Table 5 below displays frequency counts of the number of students that were successful on the Fundamentals test by TEAS V performance category. Figure 2 is a graphical depiction of the percentages from Table 5. Again, as would be expected if the TEAS is predictive of early nursing school success, there were larger proportions of students that were in the bottom two TEAS performance categories that were not successful on the subsequent Fundamentals test taken during early nursing school. Again, as TEAS performance categories increase towards *Exemplary*, the proportions of students that are deemed successful increase while those deemed not successful decrease.

Table 5. Frequencies (and percentages) of students in each TEAS V performance category by success on the Fundamentals PN test defined by Proficiency Level 2 or greater

TEAS V Academic Preparedness Category	Not Successful (< prof level 2)	Successful (≥ prof level 2)
Developmental	193 (91%)	19 (9%)
Basic	1264 (68%)	586 (32%)
Proficient	957 (40%)	1441 (60%)
Advanced	56 (18%)	262 (82%)
Exemplary	0 (0%)	6 (100%)

Note. Percentages were calculated by row such that each row totals 100%.

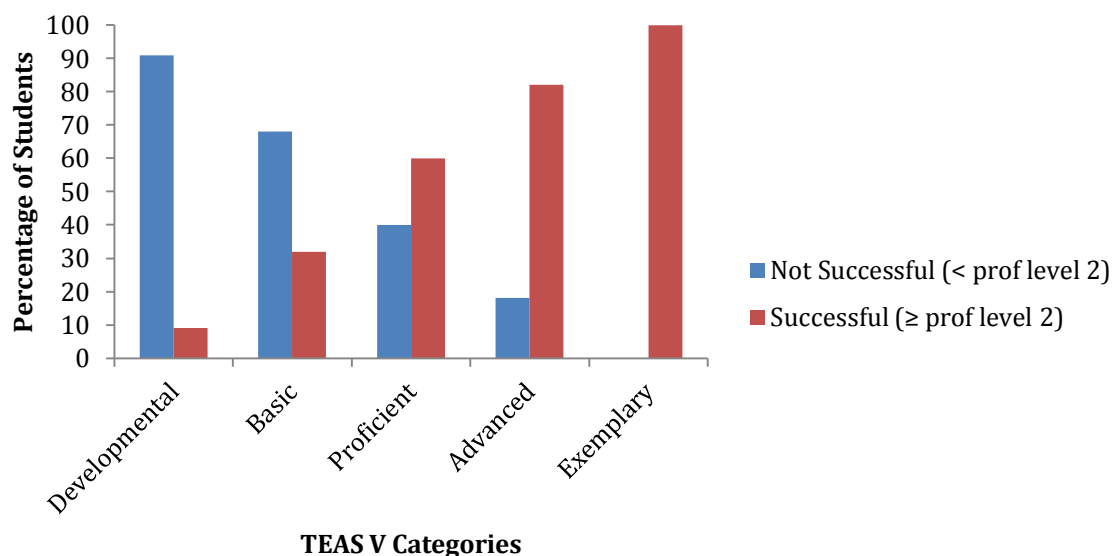


Figure 2. Percentages of students in each TEAS V preparedness category by success on the PN Fundamentals test.

## Logistic Regression

To evaluate the predictive accuracy of the TEAS V test in identifying students that were successful in early nursing school, logistic regression procedures were used to predict the dichotomous success/failure Fundamentals outcome.

### RN Students

Results indicate that for this sample of students, the model is statistically significant,  $\chi^2 = 1100.75$ ,  $df = 1$ ,  $p < .001$ , which means that a relationship likely exists between TEAS scores and Fundamentals outcome in the population. The Nagelkerke  $R^2$  value was equal to 0.18, indicating that TEAS V test scores can reduce Fundamentals prediction error by 18% as compared to the null model that does not contain TEAS V scores. Furthermore, the regression coefficient for TEAS test scores was significantly different from zero,  $\beta = .074$  ( $Wald = 914.51$ ,  $p < .0001$ ). In conjunction, these findings provide evidence that the TEAS can be used to help predict which RN students will be successful on the Fundamentals test. A logistic regression model was constructed in order to calculate probabilities of success associated with each TEAS V score level and prediction accuracy rates. These results are described in the following section.

## **PN Students**

Results indicate that the model is statistically significant,  $\chi^2 = 794.00$ ,  $df = 1$ ,  $p < .001$ , which means that a relationship likely exists between TEAS V scores and Fundamentals outcome in the population. The Nagelkerke  $R^2$  value was equal to 0.20, indicating that TEAS V test scores can reduce Fundamentals prediction error by 20%. Furthermore, the regression coefficient for TEAS test scores was significantly different from zero,  $\beta = .08$  ( $Wald = 637.88$ ,  $p < .0001$ ). In conjunction, these findings provide evidence that the TEAS can be used to help predict which PN students will be successful on the Fundamentals test.

## **Prediction Accuracy**

As mentioned, probability of success was modeled across all students in the sample. A probability level of at least .50 was chosen as the cutoff point for the probability of success (i.e., the probability of obtaining a score at or above proficiency level 2 on the Fundamentals test needed to be at least .50). Prediction accuracy rates can be defined as the percentage of students who performed as predicted. Specifically, it is equal to the number of students that the TEAS V correctly predicted (light gray boxes in Tables 6 and 7 below) divided by the number of students that actually passed or failed (dark gray boxes). The predicted accuracy rates for RN and PN students are summarized in Tables 6 and 7, respectively. However, please note that there are several cautionary claims to be made when interpreting these rates which are described in the discussion section.

In general, it appears that the TEAS test was most accurate at identifying RN students that were successful in Fundamentals and least accurate at identifying those that were not successful. Furthermore, for PN students in this sample, the TEAS test seems to identify successful and unsuccessful students equally well. As shown in the tables below, the overall accuracy rate was approximately 5% higher for RN students than it was for PN students. This may be explained by larger proportions of RN students that were correctly identified as successful or not successful around the .50 probability cutoff point. Based on the crosstabs analysis above, the TEAS may be more accurate for PN students at the extremes (i.e., *Developmental* and *Exemplary* levels) but may be less accurate for students that score at the proficient level which is where most students score.

Table 6. Prediction accuracy rates for TEAS V scores predicting RN Fundamentals outcome

Outcome	Predicted to succeed ( $\geq 50\%$ probability of success)	Predicted to Fail ( $< 50\%$ probability of success)
Actual Pass	2494	290
Actual Fail	899	451
N	3393	741
Corrected Prediction Rate	73.5%	60.9%
Overall Prediction Accuracy	71.2%	


Table 7. Prediction accuracy rates for TEAS V scores predicting PN Fundamentals outcome

Outcome	Predicted to succeed ( $\geq 50\%$ probability of success)	Predicted to Fail ( $< 50\%$ probability of success)
Actual Pass	709	450
Actual Fail	365	914
N	1074	1364
Corrected Prediction Rate	66.0%	67.0%
Overall Prediction Accuracy	66.6%	

## Discussion

There are several cautions that are warranted when interpreting these findings. First, the model itself encompasses some degree of imprecision such that the accuracy rates described above are likely an underestimation of the true rates. This is due to the probabilistic nature of the predicted classifications; since it is based on a 50% chance of success, the accuracy rate largely becomes a function of the number of students in the sample who had test scores associated with this probability (Kelley, 2011). Therefore, it is recommended that institutions evaluate the accuracy of the TEAS for predicting early nursing school success based on the students from their own classes.

Similarly, there are many factors that can impact success in early nursing school, including academic preparedness as measured by various indices as well as non-cognitive factors such as financial status, personal health, etc. As institutions use and assign differing weights to a variety of indices and measures in their admissions procedures, it may be more appropriate to build



predictive models for each individual school rather than averaged across all schools. As the present analysis did not account for institutional variations, it is reasonable to assume that these accuracy rates would fluctuate if calculated by institution. Using the TEAS test score associated with the .50 probability of success for a particular institution, in conjunction with other indices of academic preparedness, particularly to differentiate the students that are at or near this score would help increase the chances of selecting students that will be successful in early nursing school.

### **Study 3: Do successful early nursing school students perform differently on the TEAS V test than unsuccessful students?**

If the TEAS V is intended to measure academic achievement that is critical to success in early nursing school, then there should be a difference in TEAS test scores between students that were successful and those that were not successful. In other words, students that were successful in Fundamentals should have higher scores on the TEAS than students that were not successful. To determine if mean TEAS scores were different for students that were classified as successful in Fundamentals versus students classified as unsuccessful, an independent samples *t*-test was conducted.

#### **RN Students**

Results indicated that there was a significant mean difference in TEAS V test scores between RN students that were successful (mean = 72.70, SD = 10.27) on the Fundamentals test and those that were unsuccessful (mean = 63.98, SD = 11.22);  $t(8196) = 33.85, p < .00001$ . The effect size associated with this mean difference is considered large,  $d = 0.81$ . These findings suggest that RN students that go on to be successful in early nursing school, as measured by the Fundamentals test, had, on average, significantly better scores on the TEAS test than those that were not successful. RN students that were successful in their early nursing school Fundamentals course had scored approximately 9 percentage points higher on the TEAS test than their unsuccessful peers.

#### **PN Students**

Results indicated that there was a significant mean difference in TEAS V test scores between PN students that were successful (mean = 65.19, SD = 10.21) on the Fundamentals test and those that were unsuccessful (mean = 56.39, SD = 10.68);  $t(4782) = 29.43, p < .00001$ . Again, the effect size for this difference was large,  $d = 0.84$ . These findings suggest that PN students that go on to be successful in early nursing school, as measured by the Fundamentals test, had, on average, significantly better scores on the TEAS test than those that were not successful. PN students that were successful in their early nursing school Fundamentals course had scored approximately 9 percentage points higher on the TEAS test than their unsuccessful peers. Table 8 below summarizes these results for RN and PN students.

Table 8. Mean TEAS V test scores (standard deviations) by Fundamentals outcome for each program type

Fundamentals Outcome	RN	PN
<b>Successful</b> (≥ prof level 2)	72.70 (10.27) n=5532	65.19 (10.21) n=2358
<b>Not Successful</b> (< prof level 2)	63.98 (11.22) n=2666	56.39 (10.68) n=2541

## Discussion

Overall, students that were successful in Fundamentals scored significantly better than those who were not successful. This was the case for both RN and PN students. These findings further support the use of the TEAS test as an indicator of Fundamentals outcome. While the analysis is retrospective in that groups are defined by a variable that was measured after the TEAS was administered, it was valuable to compare these group differences, if anything, to provide additional evidence to support the claim that there is a meaningful relationship between performance on the TEAS and performance in Fundamentals.


## Summary

Overall, the findings presented in this report provide evidence to support the predictive validity of the TEAS V as an indicator of early nursing school success thereby supporting its use as a tool in the admissions process. The statistically significant correlation coefficients between the TEAS V test scores and the Fundamentals test are considered to be medium to large effect sizes and appear to be on par with at least one other commonly used admissions test. Success in early nursing school was then defined as obtaining a score on the Fundamentals test at or above proficiency level 2 and several analyses were conducted to evaluate the relationship between the TEAS V and success versus non-success on the Fundamentals. As would be expected if the TEAS is predictive of early nursing school success, there was a larger proportion of students that were classified as *Developmental* on the TEAS (i.e., the lowest performance category) that were not successful on the subsequent Fundamentals test than in any of the other performance categories. Conversely, as TEAS performance categories increased towards *Exemplary*, the percentages of students that were successful on the Fundamentals also increased. For instance, based on Table 5, 91% of PN students that scored at the *Developmental* level on the TEAS were unsuccessful in Fundamentals whereas 94% of students that were classified as *Advanced* or *Exemplary* on the TEAS were successful in Fundamentals. While descriptive in nature, these percentages lend support for the relationship between TEAS V test scores and Fundamentals outcome.

Using logistic regression analyses to predict Fundamentals success or non-success, it was demonstrated that TEAS test scores were a significant predictor of early nursing school success for both RN and PN students. The prediction accuracy rates calculated from the prediction equation were slightly higher for RN students than for PN students in this sample and it was suggested that the TEAS may be more accurate for PN students at the extremes (i.e., *Developmental* and *Exemplary* levels) but may be less accurate for PN students that score at the *Proficient* level. However, due to the limitations associated with prediction accuracy rate calculations, these findings should only be interpreted with caution.

Finally, results indicated that students that were successful in Fundamentals scored significantly higher on the TEAS V test than students that were not successful in Fundamentals. This information further supports the usefulness of the TEAS V as a tool in the admissions process in that there are meaningful differences in TEAS test scores that can assist educators differentiate successful and non-successful students.





Taken together, the findings presented in this report demonstrate that the TEAS V is a useful indicator of early nursing school success. While the TEAS V can be used as one measure of academic preparedness to be considered in the admissions process, it should be emphasized that a test should not be used as the sole determining factor of admittance or non-admittance to a program. Thus, it is recommended that other academic indices of academic capacity be considered when making admissions decisions.



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