

## SAUDI SCHOOL ASSESSMENT SYSTEM FOR PREDICTING ADMISSIONS TO SCIENCE COLLEGES

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**ABSTRACT:** A high variance of the quality of High School Assessment System (HSAS) is posing challenges for higher education institutions to estimate the level of rigor of high school curriculum by examining students' performance obtained through High Schools results. These results have promoted the idea of external assessment for college entry level admissions called National Assessment System (NAS). This research study is conducted to validate the students' performance differences and investigate whether there are any significant differences among both assessment systems and any performance differences among both genders. Scope of this research is limited to students getting admissions to the Science colleges in Saudi Arabia. A sample of students' performance data, containing all specialties in the science colleges, is investigated. Results indicate that there exists a significant difference between both systems and genders. The outcomes of this research study can help education sector policy makers improve the efficacy of the High School Assessment System in Saudi Arabia.

**Keywords:** Standardized tests, high school assessment, student performance, learning outcomes, box plots, aptitude tests, capacity test grade inflation.

### INTRODUCTION

Many developed countries use the standardized tests as a mean to assess student learning level and comprehension. This practice has a long history in these countries. In Saudi Arabia, the standardized tests have started in the past few years. Students in Saudi Arabia used to be awarded with certification when successfully completed the course of study with good academic records. At the last education year of secondary school, a public examination is organized by the Ministry of Education for all secondary school students in the Kingdom at the same time and the same schedule (Al-Sadan, 2000).

In general, standardized tests focus on language and basic mathematics to measure the ability of reading comprehension, logical relations and problem-solving behavior those students had accumulated during their schooling period. Some other standardized tests also measure the ability of inference and induction in the students. Almost all standardized tests consists of relatively long list of multiple choices questions to assess the applicants' academic aptitude. Students taking the standardized test are instructed to mark their choice on a separate answer sheet that is electronically scanned and scored. These tests are then used as an admission criterion by most of post high school institutions.

In the past; admission to the Saudi colleges was awarded on high school passing grades. In 2001, it was decided by the Ministry of Higher Education to add more valid and reliable selection criteria. This admission criterion must be adopted as unified approach for college admissions to all Saudi universities in the kingdom. The main components of admission criterion comprises of academic ability, National Standardized System-I (NAS-I) and National Standardized System-II (NAS-II). In the college admission process, the high school grade accounts for 20-30% of the weight in different schools. The NAS-I is conducted bi-annually and assesses the deeper understanding of the given reading materials and some mathematic problem-solving abilities in the form of multiple choice questions. In evaluation process for admissions, NAS-I accounts for 30% of the weight. The NAS-II assesses the accumulative scientific knowledge of the three-year high school scientific subjects, which are: chemistry, biology, physics, mathematics and English. The test consists of multiple choice questions and represents 30-40% of the weight of total evaluation. The NAS-I and NAS-II tests are conducted centrally under the supervision of the National Center for Assessment in Higher Education. Refer to publications by National Center for Assessment (2007) for further details.

## LITERATURE REVIEW

Due to reliability of evaluation process, standardized tests are being practiced globally. For instance; the Scholastic Aptitude Test (SAT) was first established in 1926 in USA and it took until the late 1930's to be agreed to use the test as a common admission metric (Lemann, 2004). The SAT contains separate tests in mathematics, critical reading, and writing. Later in 1959 American College Test (ACT) was established to serve two purposes: (1) to establish a common admission test that could be used across the nation as an assessment of a student's preparation for college, (2) to inform students, by asking questions about their interests, about which institution to attend and which program to study. (Evans 2013). Some studies find that high-school grade point average is consistently the best predictor not only of freshman grades in college, but of four-year college outcomes as well (Geiser & Santelices, 2007).

After examining evidence from a variety of different standardized tests, Lemann (2004) also concludes that formal test preparation is not the root cause of the disparities in test scores between low- and high-income families. Instead, he points to the inequalities in home and school environments as the most likely cause. Parents from low-income households are less likely to read to children.

In Saudi Arabia, a research study by Al-Rukban, Munshi, & Abdulghani (2010) indicates that the standardized tests could not explain more than 6.5% of the variance in the GPA of students in Saudi medical colleges. The study further concludes that there are other factors that the standardized tests don't accurately explain the variance in students' performance in the medical colleges. These factors could be academic or non-academic attributes. The study also indicates that the NAS-II was the main statistically predictive factor of performance during the undergraduate program in medical colleges. In addition, the high school percentage was not statistically predictive of students' performance at the undergraduate level of study. Furthermore; they suggest that the students with a high school percentage below 90% are strictly not qualified for admission to medical colleges.

## DATA COLLECTION

A data of 1623 students was collected from operational data of a selected college of Science in a Saudi Arabian university that contains a large population of students from different geographical zones that make up the country and cover student from many disciplines.

The overall objective of this research study is to examine the reliability of the high school assessment system for students admitted to Science College. Another objective is also to examine whether students in Science College achieve basic capacities and fundamental knowledge during their school study period in Saudi Arabia. This research study is motivated in identifying possible challenges faced by Science Colleges in their admission system.

Conclusive research approach is undertaken to know the characteristics of certain groups such as age, sex, occupation, income, and education etc. The objective of conclusive research analysis approach is to answer the "who, what, when, where and how" of the subject under study/investigation. Descriptive studies are normally factual and simple. However, such studies can be complex, demanding scientific skill on the part of researcher. Normally these types of studies are well structured. In the subsequent section data is analyzed and outcome of results is discussed.

## ANALYSIS AND DISCUSSIONS

This research study includes students graduated from the Saudi high school system in December 2012 and enrolled in the college of Science under study. A sample of 1623 students (900 males, 723 females) is obtained from a Saudi university which satisfies certain predetermined admission criterion. Data is abstractedly coded and analyzed using statistical software. Statistical tests were deployed with significance level set at 0.05 and results are presented in Table-1 and Table-2.

Table -1 below presents descriptive summary statistics of the collected data:

**Table-1:** Descriptive statistics of each assessment system

| Assessment | Mean  | Standard<br>Deviation | 1 <sup>st</sup> | Median | 3 <sup>rd</sup> | Range |
|------------|-------|-----------------------|-----------------|--------|-----------------|-------|
|            |       |                       | Quartile        |        | Quartile        |       |
| HSGPA      | 93.71 | 5.88                  | 90.92           | 94.45  | 97.15           | 30.09 |
| NAS-I      | 72.49 | 8.31                  | 68.00           | 73.00  | 77.00           | 26.00 |
| NAS-II     | 67.75 | 10.37                 | 63.00           | 68.00  | 72.00           | 80.00 |

The summary statistics (Table-1) shows that the mean of HSGPA is 93.71% with a tight standard deviation of 5.88. Based only on the HSGPA result, it means that the students are performing well in high school and they are superiorly well prepared to pursue their post-secondary studies.

Furthermore, Figures 1-4 are presented to provide a visual comparison between all three systems. Figure-1, HSGPA for college of Science students' data is strongly skewed to the right with sharp peak. This gives very small chances of having GPA in high school below 80%. The HSGPA result indicates the grades of students in high school are strongly skewed to the right. This means that the majority of scores (more than 75%) are above 90 and hence the results are not normally distributed. This is also evident from the Normal plot with confidence interval 95% in Figure-1. In the Normal plot the tails of the data doesn't follow the 95% confidence limits especially the right tail of the data.

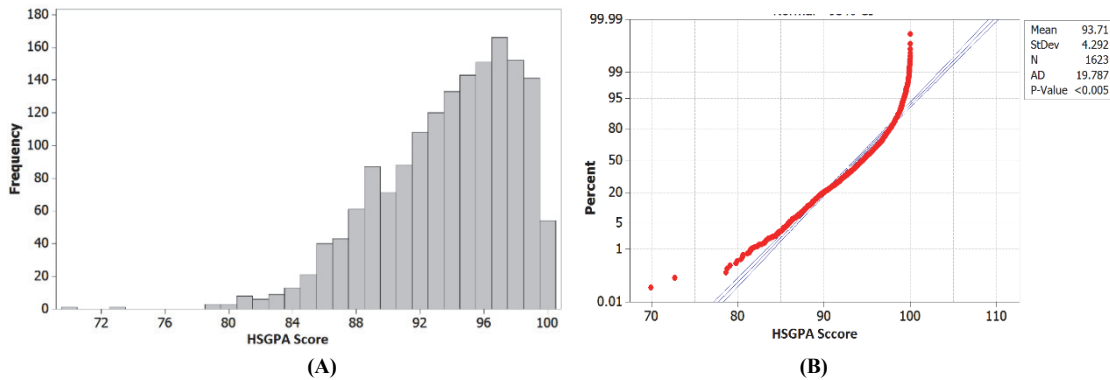


Figure-1: Histogram and Normal plot of HSGPA for the college of Science students

Comparing averages between HSGPA and both national assessment tests (NAS-I and NAS-II) show a big difference between the two categories in collage of Science. The big gap between the national assessment system and the high school assessment for college of Science students raises serious concerns about the adequacy of the learning skills and capacities of students from the high school system. Refer to Table-2. For instance, the difference between HSGPA and NAS-I in average is 21.22 indicates that the high school assessment system tends to overestimates the performance of the students of Science college.

Although NAS-II is designed to measure the overall comprehension of the students during high school, the difference in average (25.96) is even bigger between HSGPA and NAS-II. The summary of the data in Table-2, also, shows that the difference between mean and median (0.76%) for NAS-I is close to zero and one can conclude that the NAS-I scores are normally distributed. This can easily be seen from the histogram and the Normal plot of NAS-I scores in Figure-2(A). In addition, Figure-2(B) shows that most of the NAS-I scores are within the 95% confidence limits of the normal distribution.

NAS-II scores in Figure-3(A) show a more variability than NAS-I (Figure 2). The variability of NAS-II is justified by the increase in standard deviation and the quartile range. Figure-3 shows some outlier observations between 0 and 30 that need further investigation. The summary of the data for NAS-II shows that the difference between mean and median (0.34%) is close to zero and one may conclude that NAS-II scores approximately follow the normal distribution as well. The Normal plot in Figure-3(B) shows that the majority of data falls within the 95% confidence limits except for some outliers.

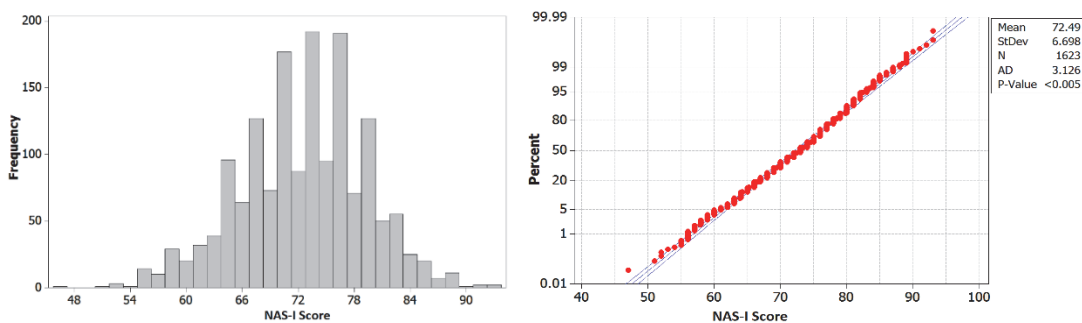


Figure-2: Histogram and Normal plot of NAS-I scores for the college of Science students

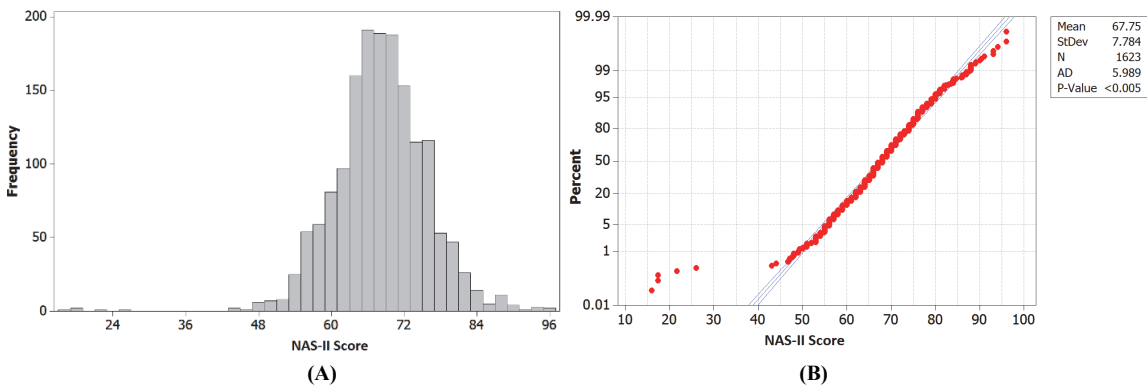


Figure-3: Histogram and Normal plot of NAS-II scores for the college of Science students

To compare between the three assessments systems we used the Box Plot depicted in Figure-4. Box plots are an excellent statistical tool for conveying location and variation information in data sets, particularly for detecting and illustrating location and variation changes between different groups of data (Chambers, et al. 1983). Obviously, the box plot of the HSGPA in Figure-4 has a completely different location compared to the other two exams NAS-I and NAS-II. If the HSGPA considered reliable in assessing the basic skills and knowledge for students the box plot should overlap in location with the box plot of NAS-I and NAS-II in the inter-quartile range of the data. In addition, Figure-4 shows that the inter-quartile range of the HSGPA (6.23%) is relatively narrow compared with the inter-quartile range of NAS-I (9%) and the inter-quartile range of NAS-II (9%).

In contrast, the comparing between NAS-I and NAS-II in box plots in Figure-4 shows that both plots share nearly 50% of the inter-quartile range. Thus, NAS-I and NAS-II are better and more reliable in evaluating student’s learning skills and knowledge background.

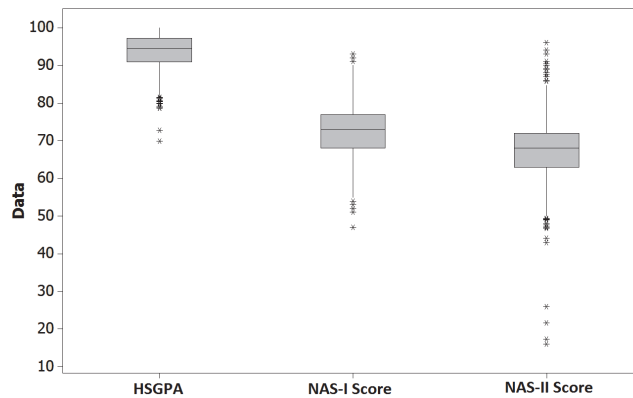


Figure-4: Box plot of high school GPA, NAS-I and NAS-II scores

Further this research study has attempted to discover whether the student’s aptitude level in the high school assessment system is same as in NAS-I for students enrolled in Science College or not. For this purpose; two-sample *t*-test (paired samples) is applied on HSGPA scores and NAS-I scores. Results of the two-sample *t*-test for the difference between HSGPA scores and NAS-I scores (Ave. Diff.), difference 95% confidence interval (Diff. 95% C.I.), *t*-value and *p*-value are listed in Table-2. Table-2 results highlighted that there is a significant difference in the aptitude level of for students obtaining HSGPA scores and NAS-I scores with 95% confidence.

HSGPA tends to overestimates the general aptitude of the students in Science College by 21.214%, on average, if the high school assessment is used to as a measure for the general aptitude.

Table-2: Results of the comparisons between HSGPA, NAS-I and NAS-II using two-sample *t*-test

| Samples        | N    | Ave. Diff. | Diff. 95% C.I. | <i>t</i> -value | <i>p</i> -value |
|----------------|------|------------|----------------|-----------------|-----------------|
| HSGPA , NAS-I  | 1623 | 21.214     | (20.83, 21.60) | 107.43          | ~ 0.0001        |
| HSGPA , NAS-II | 1623 | 25.955     | (25.52, 26.39) | 117.64          | ~ 0.0001        |
| NAS-I , NAS-II | 1623 | 4.741      | (4.24, 5.24)   | 18.60           | ~ 0.0001        |

Contrary to this; results of the two-sample *t*-test between HSGPA scores and NAS-II scores also show a significant difference, of 25.955% on average, between the two assessment systems with 95% confidence. Although, NAS-II tests the accumulated scientific knowledge acquired during the three-year high school period, the difference between HSGPA scores and NAS-II scores is even greater than HSGPA scores and NAS-II scores. A significant difference (25.96%) strongly indicates that the students admitted to Science College are lacking about 26% of the main scientific knowledge when they apply to post-secondary schools.

Results in Table-2 also demonstrate a difference of 4.74% between the average scores of NAS-I and NAS-II with 95% significance. This relatively small difference between average scores of NAS-I and NAS-II means that the level of scientific knowledge of students gained from high school is relatively close to the general aptitude of students.

## CONCLUSION

This research study is conducted to validate the students' performance differences and investigate whether there are any significant differences among both assessment systems and any performance differences among both genders. The results indicate that the HSGPA overestimates students' performance in high schools. This means that HSGPA alone is not significant to measure students' skills. The national standardized tests are critically important to be taken into account in the admission criteria in the Science college. Thus, the high school decision makers should put more emphasis on the learning skills and contents of the high schools. The scores of high school does not follow a normal distribution since it is strongly skewed to the right. Conversely, NAS-I and NAS-II scores both follow normal distribution demonstrating that the HSGPA fail to measure precisely the learning skills and comprehensions of the students.

Results indicate that there exists a significant difference between both systems. The outcomes of this research study suggests that education sector policy makers need to improve the efficacy of the High School Assessment System in Saudi Arabia to make it comparable to the results obtained by the national standardized tests. Further investigation has to be done on the teaching and learning processes during the high school.

## References

1. Geiser, S., and Santelices, M. (2007). 'Validity of High-School Grades in Predicting Student Success Beyond the Freshman Year: High-School Record vs. Standardized Tests as Indicators of Four-Year College Outcomes', Center for Studies in High Education, University of California, *Research and Occasional Paper Series* : CSHE.6.07.
2. Evans, B.J. (2013). 'College Admission Testing in America'. In *International Perspectives in Higher Education Admission Policy: A reader*, Stead, V. (Ed.). New York: Peter Lang Publishing.
3. Lemann, N. (2004). 'A history of admissions testing'. In *Rethinking the SAT: The Future of Standardized Testing in University Admissions*, New York: Routledge Flamer, 5-14
4. Al-Sadan, I. A. (2000), Educational Assessment in Saudi Arabian, *Assessment in Education*, Vol. 7, No. 1
5. Al-Rukban M., Munshi F., Abdulghani H. (2010), 'The ability of the pre-admission criteria to predict performance in a Saudi medical school', *Saudi Med Journal*; Vol. 31 (5): 560-564
6. National Center for Assessment in Higher Education. *The Aptitude Test (Online)*. (2007), [cited 2008 July 20], URL: <http://www.qeyas.com/Qiyas/info/Default.aspx>
7. National Center for Assessment in Higher Education. *The Achievement Test (Online)*. (2007), [cited 2008 July 22]. URL: <http://www.qiyas.org/Qiyas/Exams/TahseelySExams.aspx>
8. Chambers, John, William Cleveland, Beat Kleiner, and Paul Tukey, (1983), "Graphical Methods for Data Analysis", Wadsworth.