Saudi Standardized Tests and English Competence: Association and Prediction for Freshmen Medical Students' Performance in Chemistry

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Abstract

The research is created to investigate the prediction of admission criteria for medical student achievement in chemistry in Saudi Arabia. It examines if the General Aptitude Test (GAT), the Scholastic Achievement Admission Test (SAAT), and English competence, can to a certain extent predict and foretell students' achievement in the chemistry. The study sample consists of 240 participants, providing their grades in the admission criteria and chemistry. Regression analyses are utilized to define the weight of individual admission criterion prediction for student achievement in chemistry. It illustrates that admission criteria could predict students' grades in chemistry with a variance of 30%. The results also show English competence does play a more significant rule in predicting students' performance in chemistry. More research is needed to examine whether these criteria are also predictors with a large scale of students' population.

Keywords: standardized tests, English competence, chemistry education, predictive validity, medical education, college admission

1. Introduction

There is widespread concern in the Saudi academic community about the validity of the national standardized tests on which college admission is partly based. These tests are the General Aptitude Test (GAT) and Scholastic Achievement Admission Test (SAAT). The GAT is intended to test students' critical thinking skills and mathematical reasoning. The SAAT is meant to examine students' comprehension of foundational ideas in chemistry, biology, physics, and mathematics covered in high school. Students complain that such tests consume a lot of their time and effort, and yet are not necessarily related to their college learning trajectory. In addition, English competence has been used in Saudi colleges as another indicator for students' success in college, with either international/in-house standardized tests or through preparatory intensive language learning programs. There are questions on whether English competence, as well as GAT and SAAT, do predict students' performance in college. Such a major concern should be taken seriously to improve the Saudi college admission system. It also merits extensive study in several research projects.

The present study looks at the effectiveness of these standardized tests and their legitimacy for college admission. It is designed specifically to test the prediction of GAT and SAAT as standardized tests as well as English competence for freshmen students' achievement in an introductory chemistry course in their first year of college. Chemistry teachers are intrigued to learn whether students' English proficiency level does help them to perform well in the chemistry course or they need more language learning support. In addition, the teachers are interested to see whether there is a connection between students' fresh background of GAT, SAAT, and high school and their performance in the chemistry course, so they could think about how to adapt their curriculum and teaching method. The study provides an invitation to college educators to think broadly and critically about the validity of using both the GAT and the SAAT standardized tests and English competence for college admission. It will help them to think about how interrelated the three are with chemistry as a science subject. It will help specifically English and science educators to map the connection between students' performance in English and that in science and determine whether any consistent patterns exist.

The study takes place in the preparatory year program at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS). Students undertake advanced English courses in their first semester and go on to science courses in their second, including biology, chemistry, and physics. With their commutative GPA performance in

the two semesters, students get then enrolled in their specific college. The program is aimed at evaluating students' readiness for their college and nominates them for different medical majors, including medicine, dentistry, pharmacy, and applied medical sciences. Within the current literature of admission criteria and their predictive role for medical students, the present research is the first local Saudi study to take an in-depth approach to test the prediction of GAT and SAAT and English competence for students' achievement in chemistry.

There are global research attempts in various countries to study intensively student admission to medical colleges. There is one question common to these studies, which is whether the current system of medical college admission offers fair opportunities for all students and actually and accurately measures and predicts students' later performance (Schwartz, 2004; Roberts & Prideaux, 2010; McManus et al., 2011; Prideaux et al., 2011). There are different ways to assess students' skills before admission (Evans & Wen, 2007; McManus et al., 2003; Groves et al., 2007); the most common approach among medical colleges is to combine both cognitive achievements and various student personality characteristics (Albanese et al., 2003; Benbassat et al., 2007).

KSAU-HS is similar to a lot of other universities in that they prefer to employ a combination of admission criteria, which includes: students' high school grades, a test for reasoning abilities (in the Saudi context, the GAT) and an interview (Julian, 2005; Peskun et al., 2007). These universities differ in terms of which components should be counted and the numerical value assigned to each one (Parry et al., 2006). When these components are calculated together, they do predict to a certain extent students' performance in college (Ferguson et al., 2003). Thus, KSAU-HS, along with other universities, takes a holistic approach to evaluating students' performance before college.

Moreover, KSAU-HS assigns a relatively low value to students' high school grades (30%), whereas students' high school grades are seen, in different contexts, as a more predictive and reliable tool (Ferguson et al, 2002; McManus et al, 2003; Coates, 2008; Wright and Bradley, 2010; Wilkinson et al., 2008). Most Saudi universities do not place a significant value on high school grades compared to other components, the GAT and SAAT. This may indicate reduced trust in Saudi public high school education, leading these universities not to rely heavily on it.

Within this discussion of admission criteria for medical colleges and the KSAU-HS admission approach as a Saudi university, this study will serve the university as well as the entire academic community by providing a deeply statistical analysis of the relationship between admission criteria and students' performance in chemistry in their first year of college.

2. Overview

The chemistry course in the KSAU-HS pre-professional program is designed for beginner and non-major chemistry students. Students are expected to learn about major subjects: general and organic chemistry. In the first part of the course, students focus on general chemistry, learning specifically about:

- Chemical Foundations.
- Atomic structures, chemical bonding, and electron configuration.
- Types of chemical reactions and oxidation reduction.
- Mole concept, chemical equations, and reaction stoichiometry.
- Aqueous solutions.
- Acids, bases, and buffers.

In the second part of the course, students learn about organic chemistry, focusing on:

- Structure and bonding in organic molecules.
- Functional groups and chemistry of carbon.
- Saturated and unsaturated hydrocarbons: alkanes, alkenes, and alkynes.
- Aromatic compounds.
- Stereochemistry.

Students then get tested through two midterms and the final, with English as a medium of instruction.

As for measuring students' English competence, this study employs two methods. The first takes the average of students' scores in English courses they take in their first semester. These courses include reading, grammar, and communication. The second determines students' reading and communication proficiency, through separated

tests reviewed and edited by language teacher experts. The goal of the reading test is to students' ability to understand academic texts written, with a focus on inference abilities. Students in the test must explain their skills in finding the major idea and supportive examples in a reading text. Also, they should apply critical thinking strategies to get the meaning beyond and between the lines. They should be able to distinguish between beliefs and scientific facts and cause and effect and interpret diagrams and charts. The reading test emphasizes on students' awareness of vocabulary and its parts of speech.

In the communication test, students should be able to use diverse writing styles, including comparison and cause and effect. They should be able to reword, summarize, and compose an essay. Students are specifically required to illustrate pre-determined communication skills which include: analyzing and making conclusions from a reading passage, understanding the discourse organization of the reading text, framing a topic statement with a clear and cohesive paragraph, and writing a paragraph with one main idea and supportive examples.

Both tests, with the addition of English average score, are the components of English competence employed in this research for foretelling students' achievement in chemistry.

3. Research Questions

The research questions investigate the prediction of the GAT and SAAT as well as English competence for students' achievement in chemistry. They are the following:

- Does each admission criterion independently as independent variables foretell students' achievement in chemistry?

- When the admission criteria are put together statistically, what is their predictive variance for students' achievement in chemistry?

4. Method

This study gathered the grades of English average, the reading and communication tests, GAT, SAAT, and chemistry from 240 male students. The data then were inserted in the SPSS program and run into statistical regression analyses. Independent variables were English average score, reading test, communication test, and GAT, SAAT whereas the chemistry score was the main dependent one.

5. Results

For the examination of each predictor individually, the study used simple linear regression. Table 1 shows the variance of each predictor and its significance for the chemistry grade. It reveals that individually English average has the highest predictive power (R-square=24.6%) following by the reading test (R-square=15.7%) and then the communication test – (R-square=14.4%). GAT and SAAT are not strong predictors of the dependent variable (R-square=3.4% and 1.8% respectively). However, the multivariate regression model is stronger – explaining 30.1% variance of the dependent variable, as shown in Table 2. Table 3 shows that two metrics – English average ($p<0.0005$) and the communication test ($p<0.05$) are the most significant predictors of the chemistry grade. The regression formula of foretelling the chemistry score is = 0.254 + 0.150* communication test + 0.071* reading test + 0.627* English average + .0.014* GAT - 0.008* SAAT.

Table 1. Prediction of each independent variable

Model	Variable	R	R Square	Adjusted R Square	Regression Coefficient	Std. Error	t	Coefficient p-value
1	GAT	0.183	.034	.030	0.026	0.009	2.889	0.004
2	SAAT	0.136	.018	.014	0.019	0.009	2.111	0.035
3	English average	0.496	.246	.243	0.809	0.093	8.699	0.000
4	Reading test	0.396	.157	.154	0.316	0.047	6.723	0.000
5	Communication test	0.38	.144	.141	0.353	0.056	6.304	0.000

Table 2. Prediction of combined independent variables

Model	Variable	R	R Square	Adjusted R Square	Std. Error of The Estimate
1	CT, GAT, SAAT, ENGL, RT	0.549	.301	.286	0.627

Predictors: (Constant) Communication test (CT), SAAT, GAT, English average (ENGL), Reading test (RT).

Table 3. Coefficients analysis

Model		Coefficients[a]				
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.254	0.900		0.282	.778
	GAT	.014	.009	.097	1.589	.113
	SAAT	-.008	.009	-.057	-0.936	.350
	English average	.627	.108	.385	5.822	.000 (P<0.0005)
	Reading test	.071	.063	.088	1.127	.261
	Communication test	-150	.069	.160	2.165	.031 (P<0.05)

a. Dependent Variable: Chemistry grade

6. Discussion

Analysis of these results yields some interesting findings. It confirms that each of the predictors is individually significant for students' performance in chemistry. However, the English average and reading and communication tests were the best predictors, whereas GAT and SAAT have significantly lower predictive value. It was not surprising that the English average along with students' excellence in reading and communication skills predict strongly for their chemistry grade since it is personally observed by English academic faculty at KSAU-HS that there is a connection between performance in English and that in chemistry. When students have solid and reliable English skills, they generally tend to perform well in science courses.

However, what comes as a shock is that both GAT and SAAT are individually predictors with lower values (R-square=3.4% and 1.8% respectively). Even in the combined model, both are not significant predictors, as the analysis of the coefficients confirms. Such results call for further inquiry. While this study focused on one science course (chemistry), what about the prediction of both GAT and SAAT for other science courses? Does it fall into the same pattern? If so, what is the problem? Why is there little connection between these tests and students' performance in college? One of the possible reasons for this scant connection is that GAT and SAAT are designed for specific purposes, evaluating students' learning in high school and generally assessing their intellectual abilities. They are not aimed at, or suitable for, confirming students' readiness for college, nor guessing their success in college, as the results of this study show.

What is also astonishing is that standardized tests in other countries besides Saudi Arabia generally have less predictive value (McManus et al., 2005a, 2005b). In addition, the prediction of standardized tests decreases over the four years of college, as Geiser and Santelices (2007) assert. This challenges the conventional view that standardized tests are good predictors for students' college success; although these tests are methodologically rigorous and provide an easy and uniform yardstick for evaluating students' skills, this does not mean that they are reliable predictors for success.

Moreover, the combined model of independent variables explains 30% R-square of chemistry variance. The model illustrates a moderate relationship between the predictors and chemistry grade. Within other studies on prediction of admission criteria, it has been seen that the variance of the combined model is usually low to moderate, whereas a large proportion of the variance is unexplained (Callahan et al., 2010; James et al., 2010; Lynch et al., 2009; Evans & Wen 2007). This study confirms that 70% of the variance is unexplained; suggesting that among predictive studies the unexplained variance may extend to 70% (Ferguson et al., 2002).

It is recommended that for better prediction for college admission, more variables should be included and tested to see if they relate to students' performance in college (Benbassat et al., 2007). These variables include admission interviews, personality tests, and high school internships. In addition, when colleges intend to employ a combination of several admission criteria, this practice should be tested and shared with the academic community (Ferguson et al., 2003; Parry et al., 2006).

7. Conclusion

Students' performance in an introductory chemistry course at KSAU-HS is partially dependent on their English average and success in communication and reading tests. The combined model explains only 30% of the variance in chemistry, confirming GAT and SAAT are not significant predictors. However, this study has a limited number of students, and although it does present some interesting findings, it would be preferable to conduct a large national study for the Saudi community to evaluate such findings and reshape them for better

educational progress and college admission. Saudi educators are invited to use the admission data available at their universities and establish different studies regarding the prediction of admission criteria for students' performance in college and in certain majors and subjects. It would be a remarkable addition to the library of Saudi research and to the global inquiry into predictive admission criteria.

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